2003 SUSPENSION

Front Suspension - Blazer, S10, Jimmy & Sonoma

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
Ball Joint Nuts (Replacement Joint)	23 N·m	17 lb ft
Drive Axle Nut (4WD)	140 N·m	103 lb ft
Lower Ball Joint to Steering Knuckle Nut	108 N·m	79 lb ft
Lower Control Arm Bumper Nut	25 N·m	18 lb ft
Lower Control Arm to Frame Front Pivot Bolt (RWD)	115 N·m	85 lb ft
Lower Control Arm to Frame Nut (4WD)	110 N·m	81 lb ft
Lower Control Arm to Frame Rear Pivot Bolt (RWD)	98 N·m	72 lb ft
Shock Absorber Lower and Upper Nuts (4WD)	73 N·m	54 lb ft
Shock Absorber Lower Bolts (RWD)	30 N·m	22 lb ft
Shock Absorber Upper Nut (RWD)	12 N·m	106 lb in
Spindle Nut	16 N·m	12 lb ft
Splash Shield Bolts (RWD)	26 N·m	19 lb ft
Stabilizer Shaft Bracket to Frame Bolts (4WD)	65 N·m	48 lb ft
Stabilizer Shaft Bracket to Frame Bolts (RWD)	36 N·m	26 lb ft
Stabilizer Shaft Link to Lower Control Arm Nut (4WD)	15 N·m	11 lb ft
Stabilizer Shaft Link to Lower Control Arm Nut (RWD)	18 N·m	13 lb ft
Tie Rod to Steering Knuckle Nut	53 N·m	39 lb ft
Torsion Bar Support Lower Link Nut	50 N·m	37 lb ft
Torsion Bar Support Upper Link Nut	65 N·m	48 lb ft
Upper Ball Joint to Steering Knuckle Nut	83 N·m	61 lb ft
Upper Control Arm Bumper (4WD)	27 N·m	20 lb ft
Upper Control Arm Shaft Nuts (RWD)	115 N·m	85 lb ft
Upper Control Arm to Frame Nuts (4WD)	115 N·m	85 lb ft
Upper Control Arm to Frame Nuts (RWD)	75 N·m	55 lb ft
Wheel Hub and Bearing Assembly to Steering Knuckle Bolts (4WD Pickup and Utility)	105 N·m	77 lb ft
Wheel Speed Sensor Bracket and Brake Hose Bracket Nuts	18 N·m	13 lb ft
Wheel Speed Sensor to Wheel Hub and Bearing Assembly Bolt (4WD Pickup and Utility)	24 N·m	18 lb ft

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Fig. 1: Fastener Tightening Specifications
Courtesy of GENERAL MOTORS CORP.

REPAIR INSTRUCTIONS

STABILIZER SHAFT REPLACEMENT (RWD)

Removal Procedure

1. Raise and suitably support the vehicle with safety stands. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the tire and wheel assembly. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.

Important: When you remove parts from the right side and the left side of the vehicle, keep the parts separated.

3. Remove the stabilizer shaft links. Refer to **STABILIZER SHAFT LINK REPLACEMENT (RWD)** or **STABILIZER SHAFT LINK REPLACEMENT (4WD)** .
4. Remove the stabilizer shaft bracket mounting bolts.
5. Remove the stabilizer shaft brackets.
6. Remove the stabilizer shaft.
7. Remove stabilizer shaft insulators from stabilizer shaft.
8. Inspect all of the parts for wear and damage.

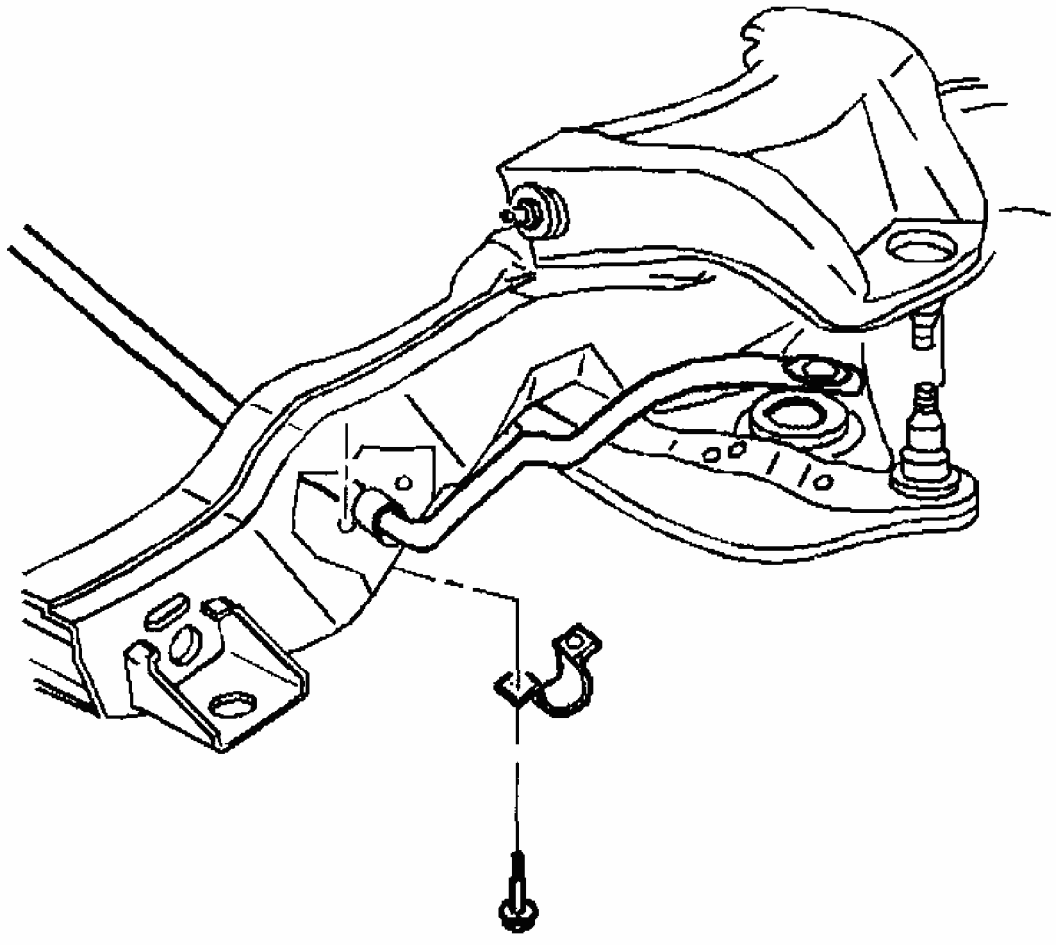

Fig. 2: Stabilizer Shaft
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the stabilizer shaft insulators to the stabilizer shaft with the slits facing the front of the vehicle.
2. Install the stabilizer shaft.
3. Install the stabilizer shaft brackets over the stabilizer shaft insulators.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

4. Install the stabilizer shaft bracket mounting bolts.

   Tighten

   Tighten the stabilizer shaft bracket mounting bolts 36 N.m (26 lb ft).

5. Install the stabilizer shaft links. Refer to **STABILIZER SHAFT LINK REPLACEMENT (RWD)** or **STABILIZER SHAFT LINK REPLACEMENT (4WD)** .
6. Install the tire and wheel assembly. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
7. Lower the vehicle.

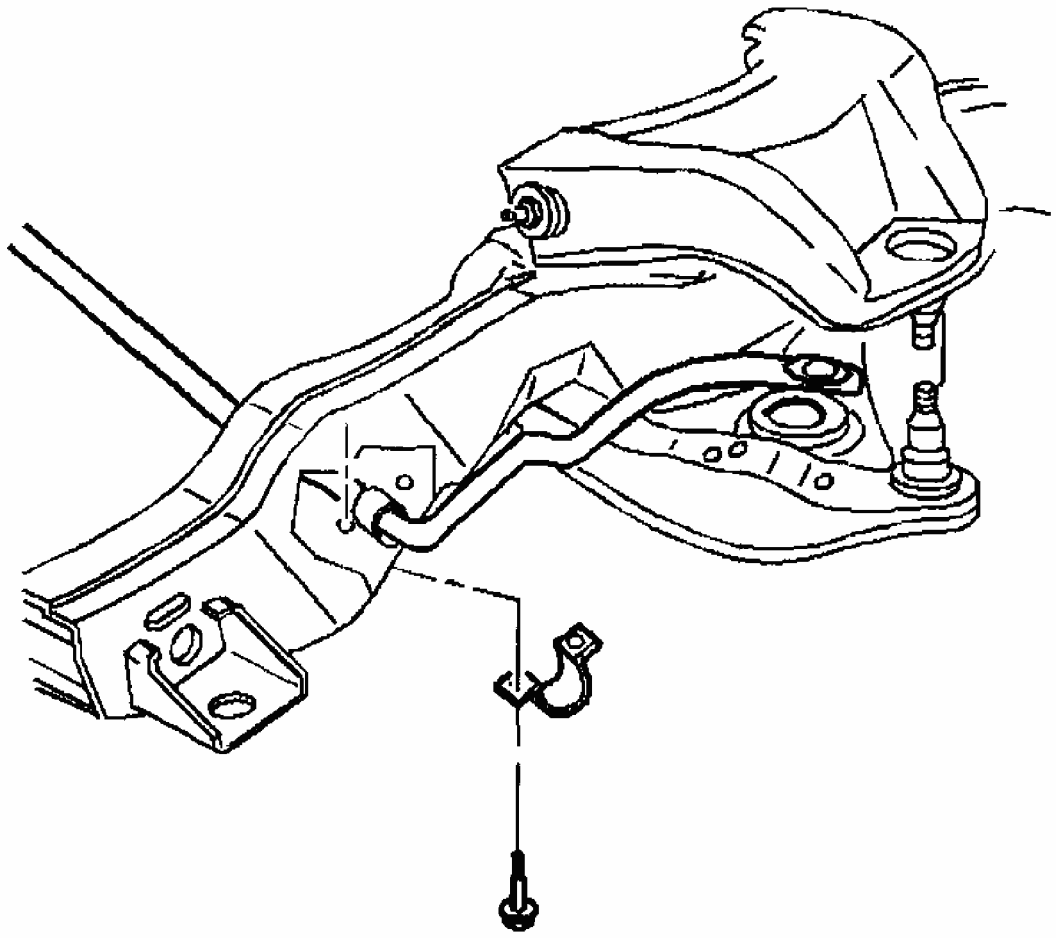

Fig. 3: Stabilizer Shaft
Courtesy of GENERAL MOTORS CORP.

STABILIZER SHAFT REPLACEMENT (4WD)

Removal Procedure

1. Raise and suitably support the vehicle with safety stands. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the steering linkage shield. Refer to **STEERING LINKAGE SHIELD REPLACEMENT** in Steering Linkage.

   Important: Remove the parts from the right front and the left front of the vehicle. Keep the parts separated.

3. Remove the stabilizer shaft links. Refer to **STABILIZER SHAFT LINK REPLACEMENT (RWD)** or **STABILIZER SHAFT LINK REPLACEMENT**

(4WD) .

4. Remove the stabilizer shaft bracket mounting bolts.
5. Remove the stabilizer shaft brackets.
6. Remove the stabilizer shaft.
7. Remove the stabilizer shaft insulators.
8. Inspect all of the parts for wear or damage.

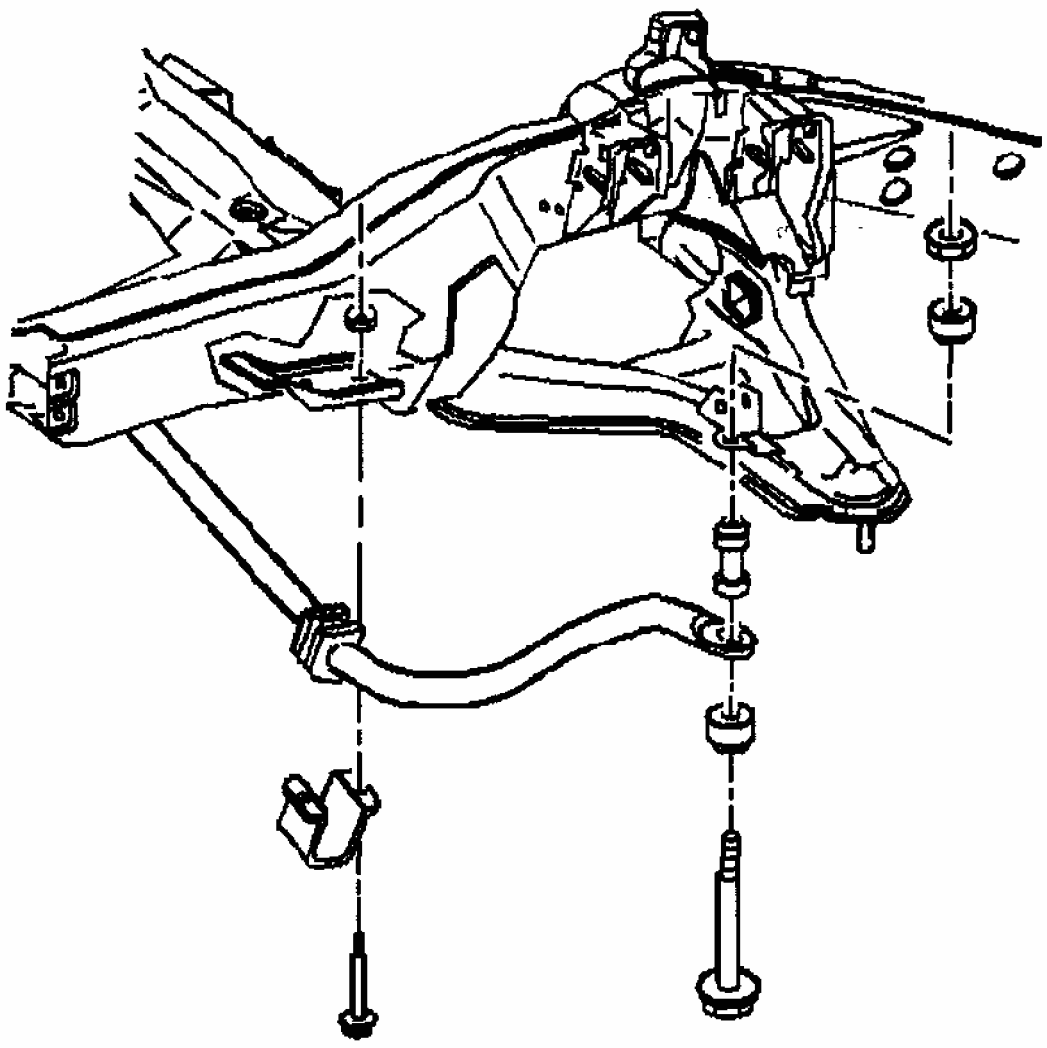

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Fig. 4: Stabilizer Shaft
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the stabilizer shaft insulators to the stabilizer shaft. Face the slit in the stabilizer shaft insulator forward.
2. Install the stabilizer shaft to the frame and to the lower control arm.
3. Install the stabilizer shaft brackets over the stabilizer shaft insulators.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

4. Install the stabilizer shaft bracket mounting bolts.

   Tighten

   Tighten the stabilizer shaft bracket mounting bolts to 65 N.m (48 lb ft).

5. Install the stabilizer shaft links. Refer to **STABILIZER SHAFT LINK REPLACEMENT (RWD)** or **STABILIZER SHAFT LINK REPLACEMENT (4WD)** .
6. Install the steering linkage shield. Refer to **STEERING LINKAGE SHIELD REPLACEMENT** in Steering Linkage.
7. Lower the vehicle.

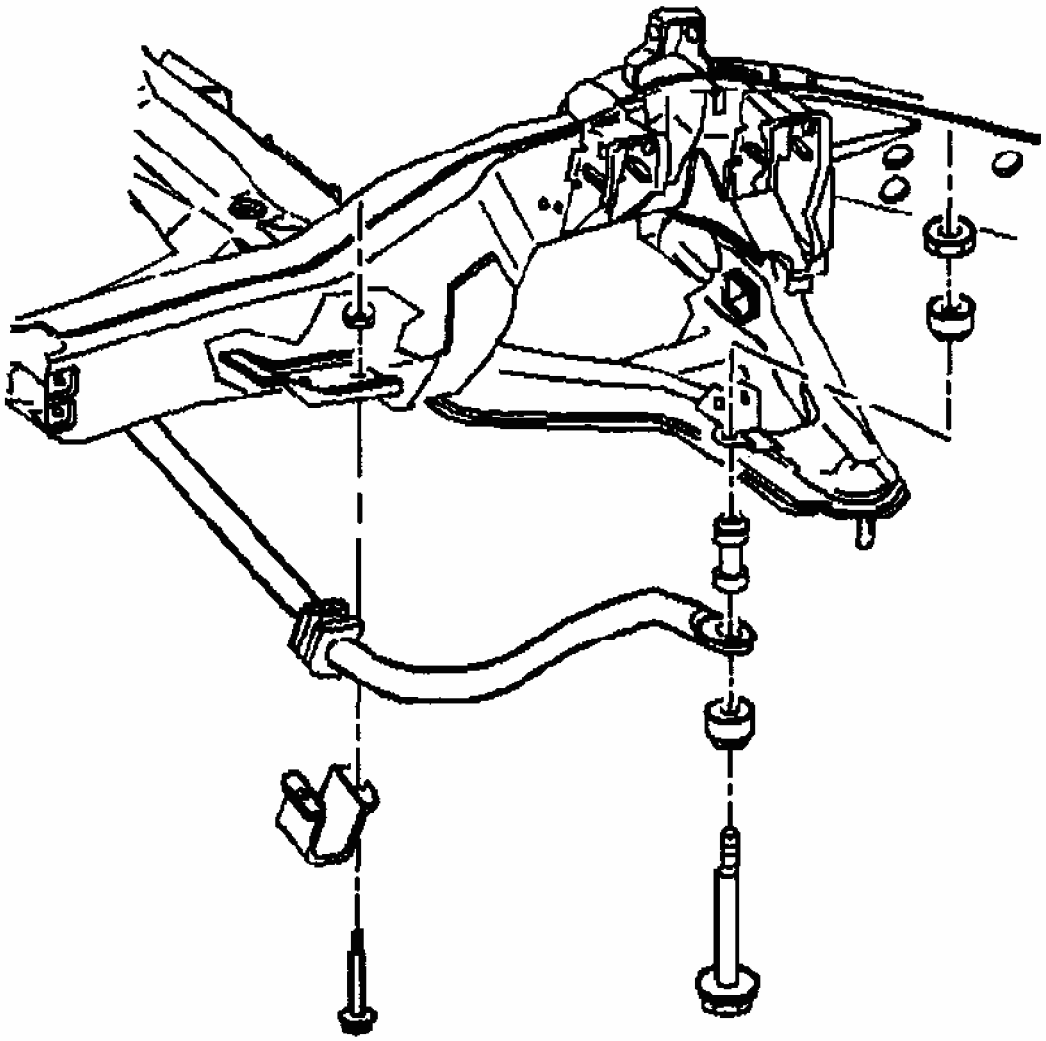

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Fig. 5: Stabilizer Shaft
Courtesy of GENERAL MOTORS CORP.

STABILIZER SHAFT LINK REPLACEMENT (RWD)

Removal Procedure

1. Raise and suitably support the vehicle with safety stands. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the tire and wheel assembly. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
3. Remove the to the stabilizer shaft link retaining nut.
4. Remove the retainers from the stabilizer shaft link bolt.

5. Remove the grommets from the stabilizer shaft link bolt.
6. Remove the following parts from the stabilizer shaft link bolt:
    6.1 The grommet
    6.2 The retainer
    6.3 The spacer
    6.4 The retainer
    6.5 The grommet

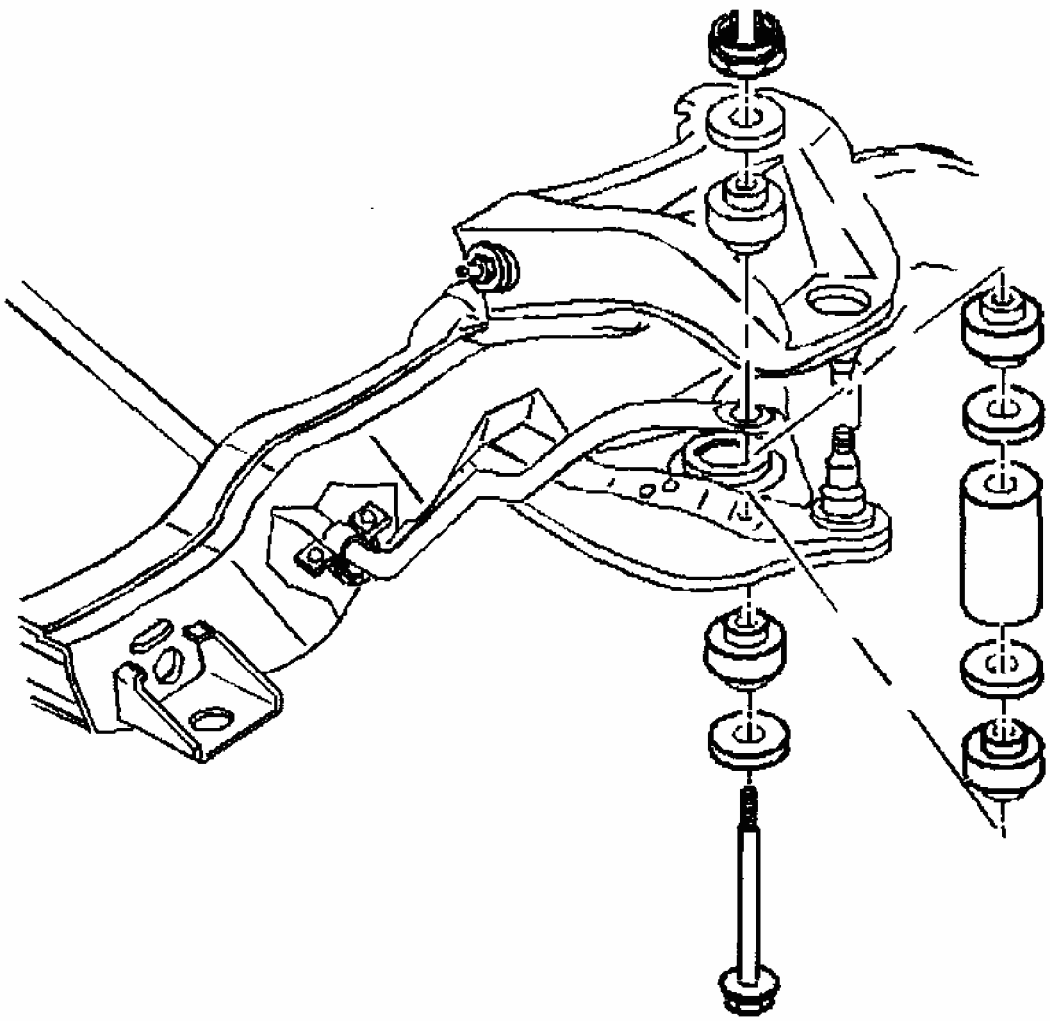

Fig. 6: Stabilizer Shaft Link
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the retainers and the grommets to the stabilizer shaft link bolt. Position the parts correctly.
2. Install the stabilizer shaft link bolt through the lower control arm hole. Stack the parts in the following order:
    2.1 The grommet
    2.2 The retainer
    2.3 The spacer
    2.4 The retainer
    2.5 The grommet
3. Install the stabilizer shaft link bolt through the upper control arm hole.
4. Install the grommets to the stabilizer shaft link bolt.
5. Install the retainers to the stabilizer shaft link bolt.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

6. Install the to the stabilizer shaft link retaining nut to the stabilizer shaft link bolt until the nut meet the end of the bolt threads.

    Tighten

    Tighten the stabilizer shaft link retaining nut to 18 N.m (13 lb ft).

7. Install the tire and wheel assembly. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
8. Lower the vehicle.

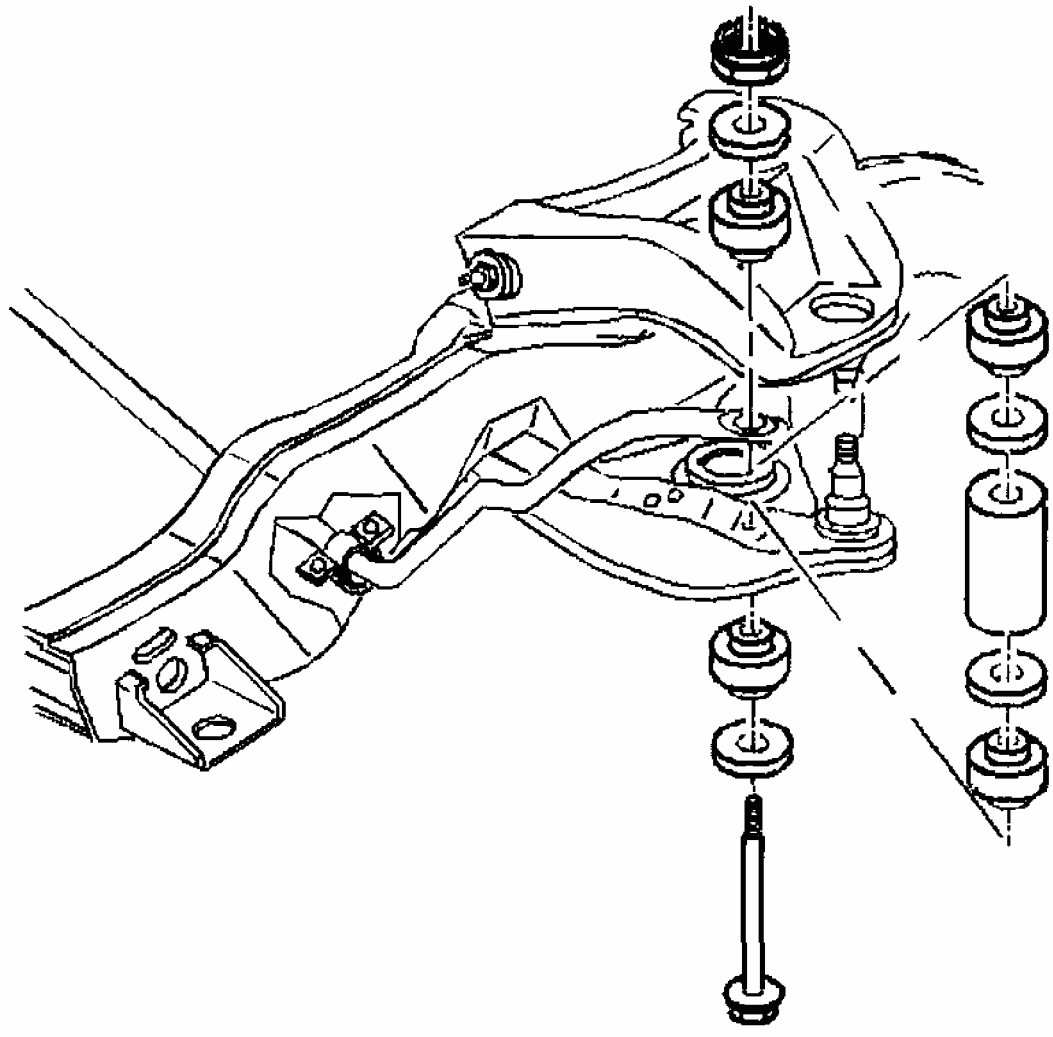

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Fig. 7: Stabilizer Shaft Link
Courtesy of GENERAL MOTORS CORP.

STABILIZER SHAFT LINK REPLACEMENT (4WD)

Removal Procedure

1. Raise and suitably support the vehicle with safety stands. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the stabilizer shaft link bolt.
3. Remove the stabilizer shaft link insulator, spacer, and upper retainer.
4. Inspect all of the parts for wear or damage.

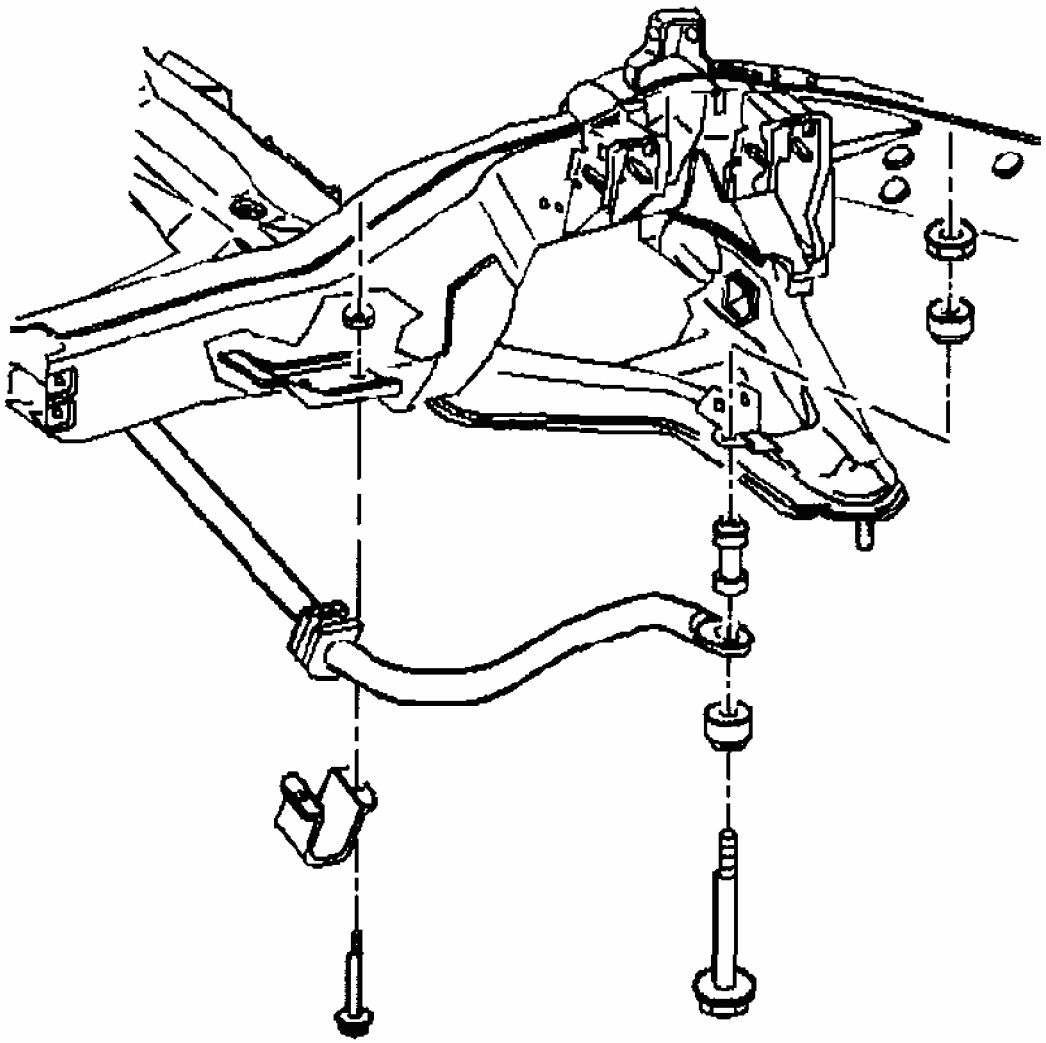

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Fig. 8: Stabilizer Shaft Link
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the stabilizer shaft link insulators to the stabilizer shaft link bolt.
2. Install the stabilizer shaft link bolt through the stabilizer shaft.
3. Install the stabilizer shaft link spacer.
4. Install the stabilizer shaft link bolt through the lower control arm with the parts stacked properly.
5. Install the stabilizer shaft link upper retainer.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

6. Tighten the stabilizer shaft link bolt.

   Tighten

   Tighten the stabilizer shaft link bolt to 15 N.m (11 lb ft).

7. Lower the vehicle.

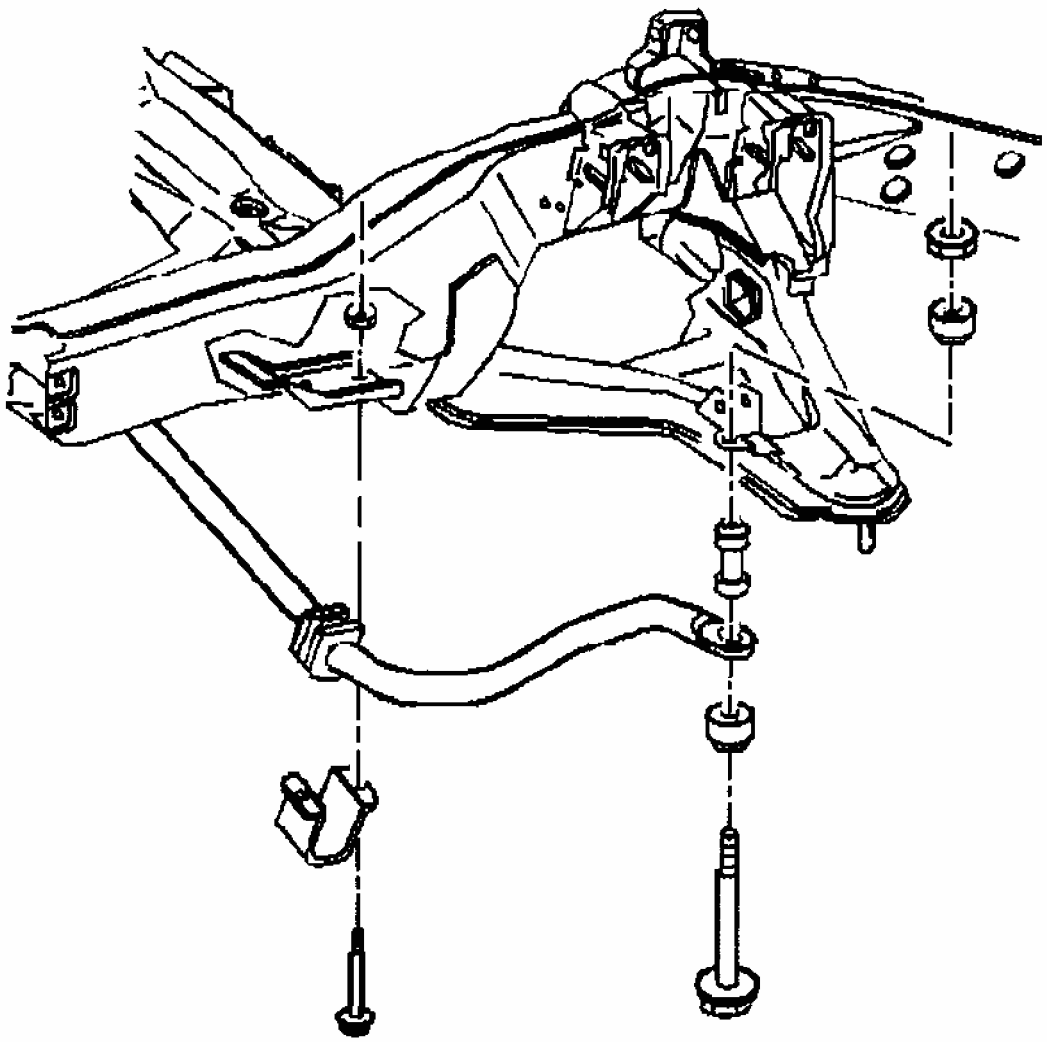

Fig. 9: Stabilizer Shaft Link
Courtesy of GENERAL MOTORS CORP.

STABILIZER SHAFT INSULATOR REPLACEMENT (RWD)

Removal Procedure

1. Raise and suitably support the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the stabilizer shaft bracket mounting bolts.
3. Remove the stabilizer shaft bracket.
4. Lower the stabilizer shaft and remove the stabilizer shaft insulator.

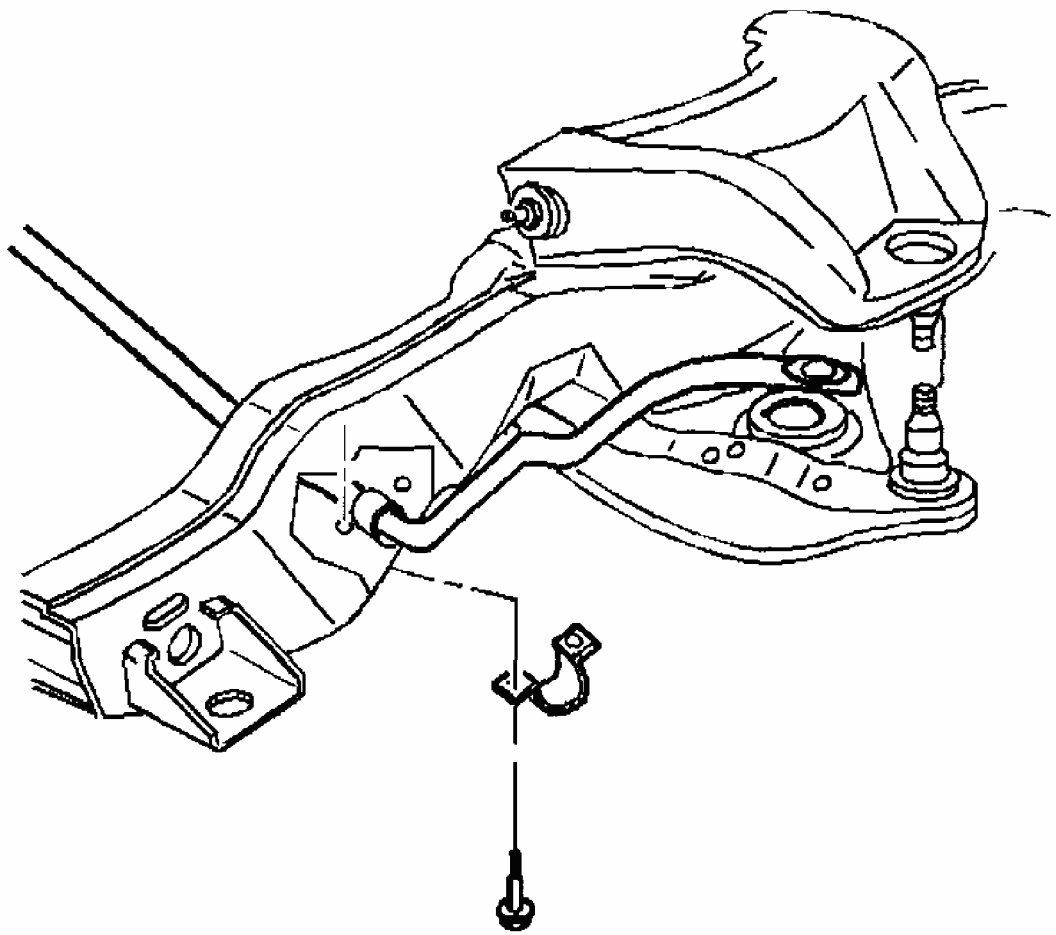

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Fig. 10: Stabilizer Shaft Insulator
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the stabilizer shaft insulator to the stabilizer shaft with the slits facing the front of the vehicle.

2. Install the stabilizer shaft bracket over the stabilizer shaft insulator.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

3. Install the stabilizer shaft bracket mounting bolts.

Tighten

Tighten the stabilizer shaft bracket mounting bolts to 36 N.m (26 lb ft).

4. Lower the vehicle.

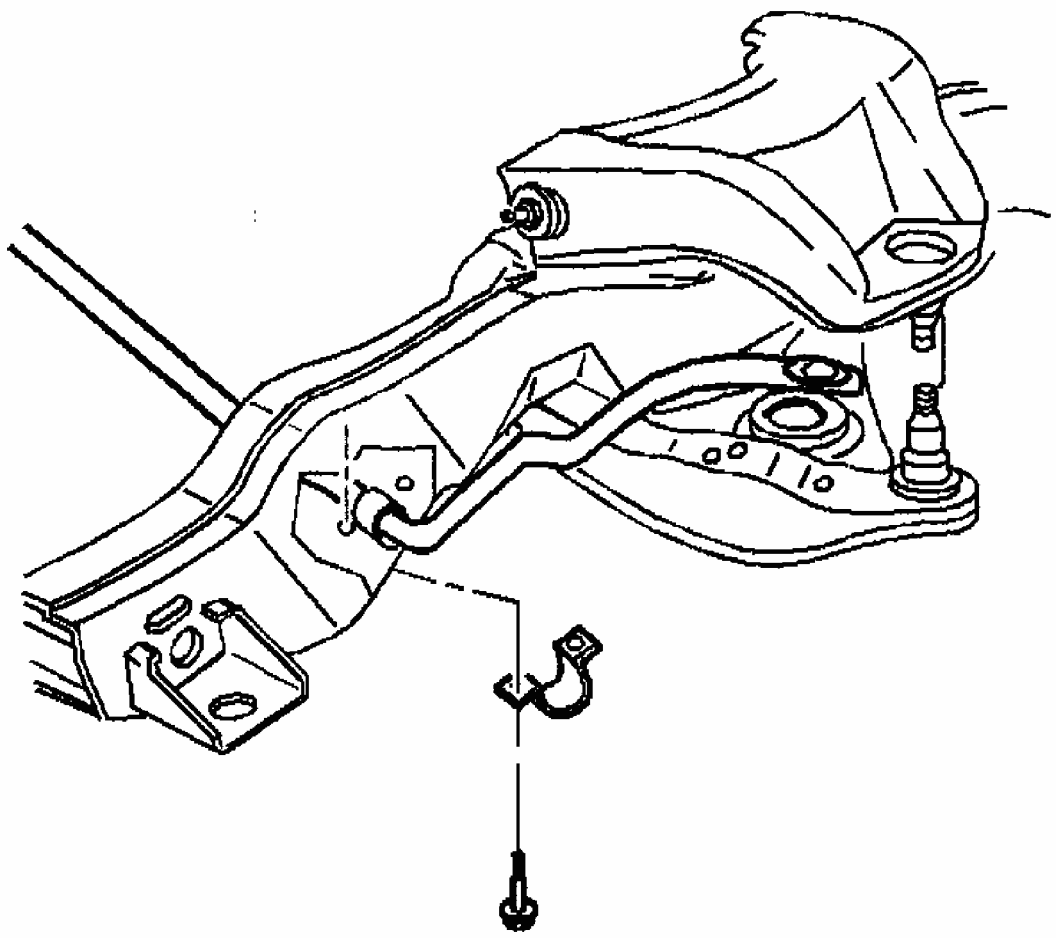

Fig. 11: Stabilizer Shaft Insulator
Courtesy of GENERAL MOTORS CORP.

STABILIZER SHAFT INSULATOR REPLACEMENT (4WD)

Removal Procedure

1. Raise and suitably support the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the steering linkage shield. Refer to **STEERING LINKAGE SHIELD REPLACEMENT** in Steering Linkage.
3. Remove the stabilizer shaft bracket mounting bolts.
4. Remove the stabilizer shaft bracket.
5. Remove the stabilizer shaft insulator.

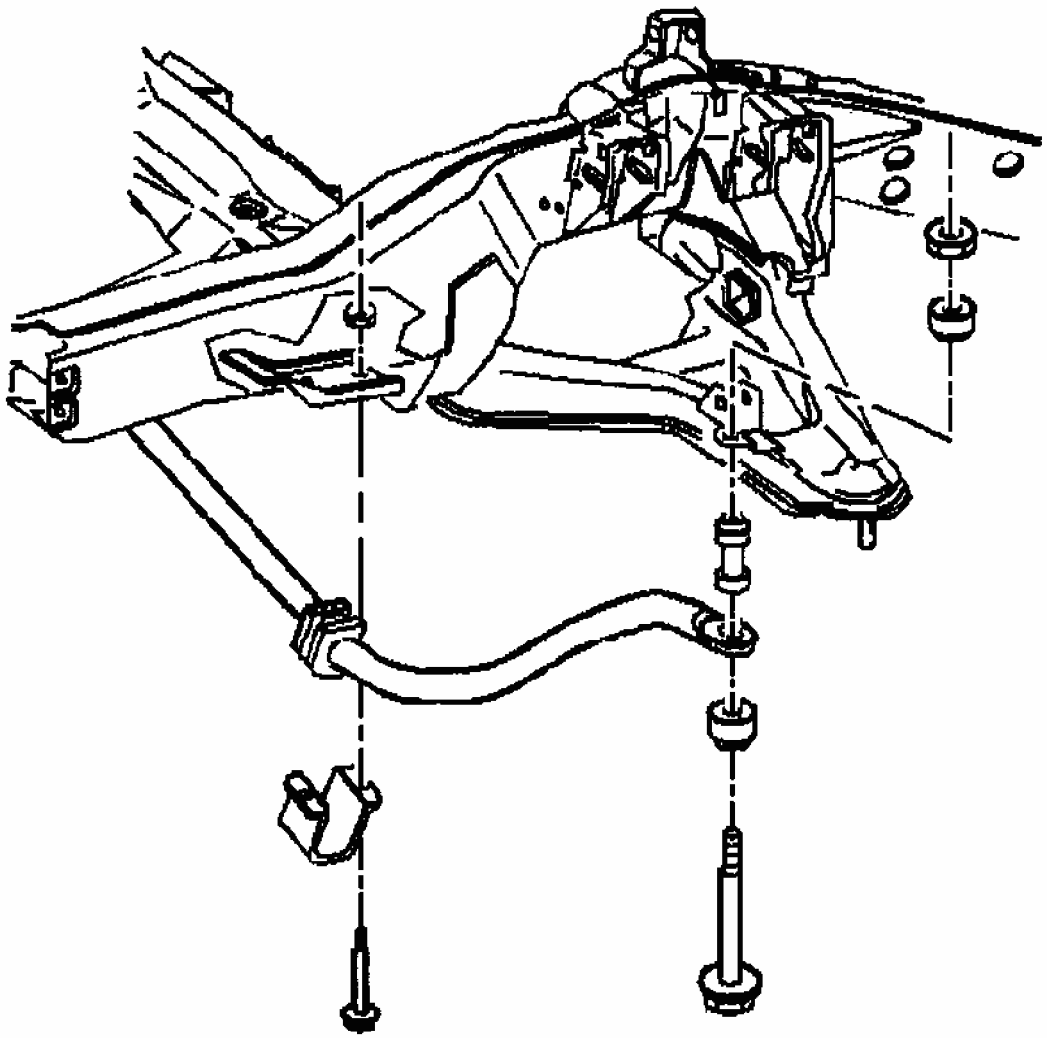

Fig. 12: Stabilizer Shaft Insulator
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the stabilizer shaft insulator to the stabilizer shaft. Face the slit in the stabilizer shaft insulator forward.
2. Install the stabilizer shaft bracket over the stabilizer shaft insulator.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

3. Install the stabilizer shaft bracket mounting bolts.

   Tighten

   Tighten the stabilizer shaft mounting bracket bolts to 65 N.m (48 lb ft).

4. Install the steering linkage shield. Refer to **STEERING LINKAGE SHIELD REPLACEMENT** in Steering Linkage.
5. Lower the vehicle.

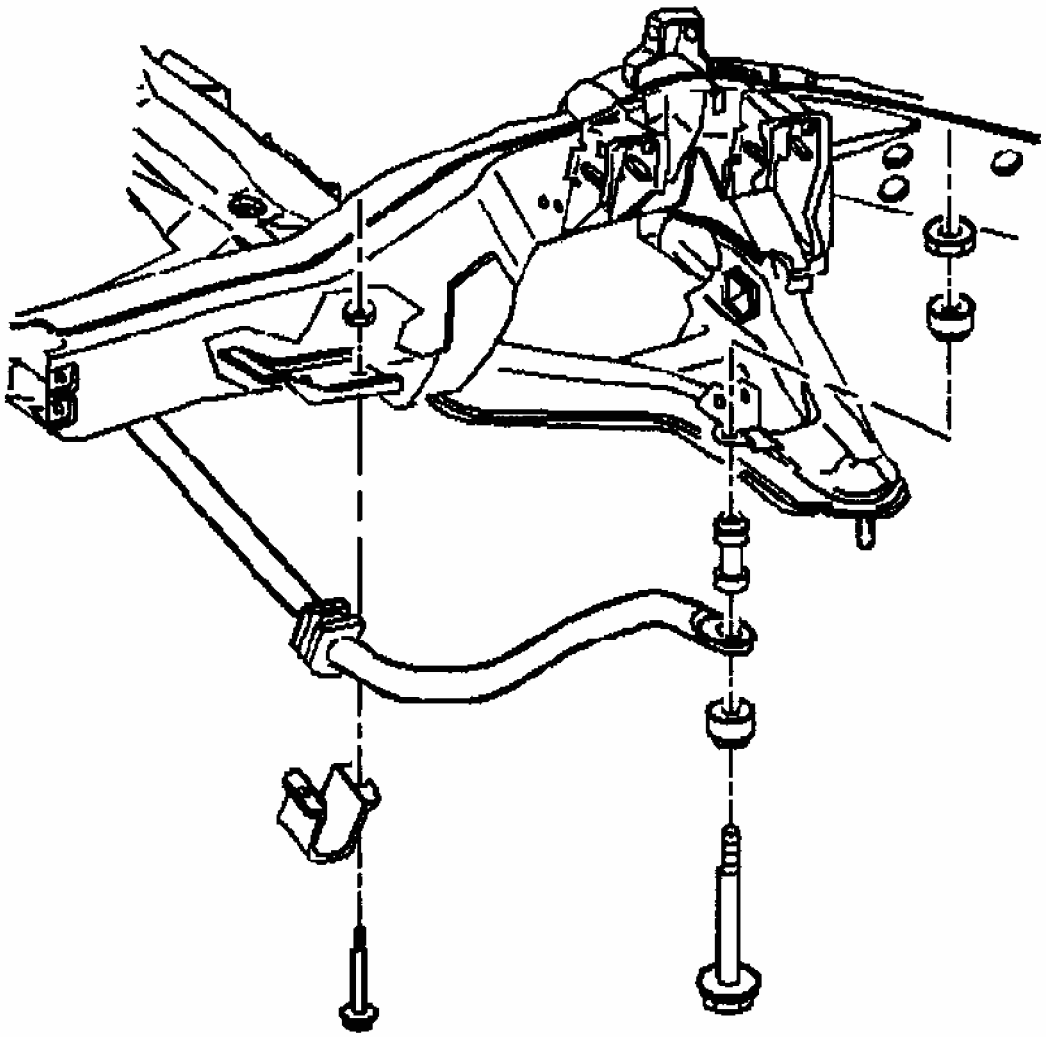

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Fig. 13: Stabilizer Shaft Insulator
Courtesy of GENERAL MOTORS CORP.

UPPER BALL JOINT REPLACEMENT (RWD)

Tools Required

J 23742 Ball Joint Separator

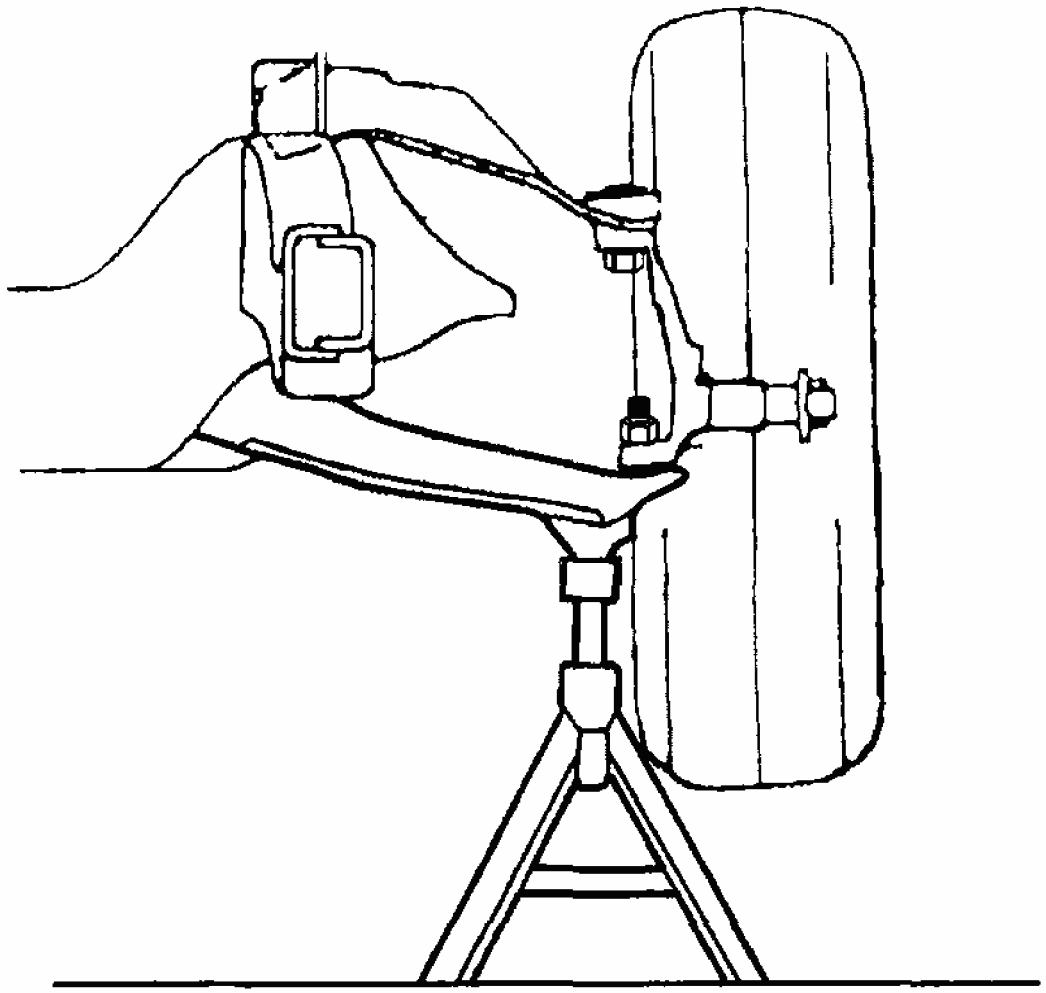

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Fig. 14: Supporting Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

Removal Procedure

CAUTION: Refer to FLOOR JACK CAUTION in Cautions and Notices.

1. Raise and suitably support lower control arm with safety stands. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Because the weight of the vehicle is used to relieve spring tension on the upper control arm, position the floor stands between the spring seats and the ball joints of the lower control arms.
3. Remove the tire and wheel assembly. Refer to **TIRE AND WHEEL REMOVAL**

AND INSTALLATION in Tires and Wheels.

NOTE: Support the caliper with a piece of wire to prevent damage to the brake line.

4. Remove the brake caliper. Refer to **BRAKE CALIPER -- FRONT SINGLE PISTON** or **BRAKE CALIPER -- FRONT DUAL PISTON** in Disc Brakes.
5. Remove the cotter pin.
6. Remove wheel speed sensor electrical connector from upper control arm.
7. Disconnect wheel speed sensor electrical connector.
8. Remove the upper ball joint stud nut.
9. Separate the ball joint from the steering knuckle using *J 23742* .
10. Apply pressure on the tool until the stud breaks loose.
11. Remove the *J 23742* .
12. Pull the ball joint stud away from the steering knuckle.

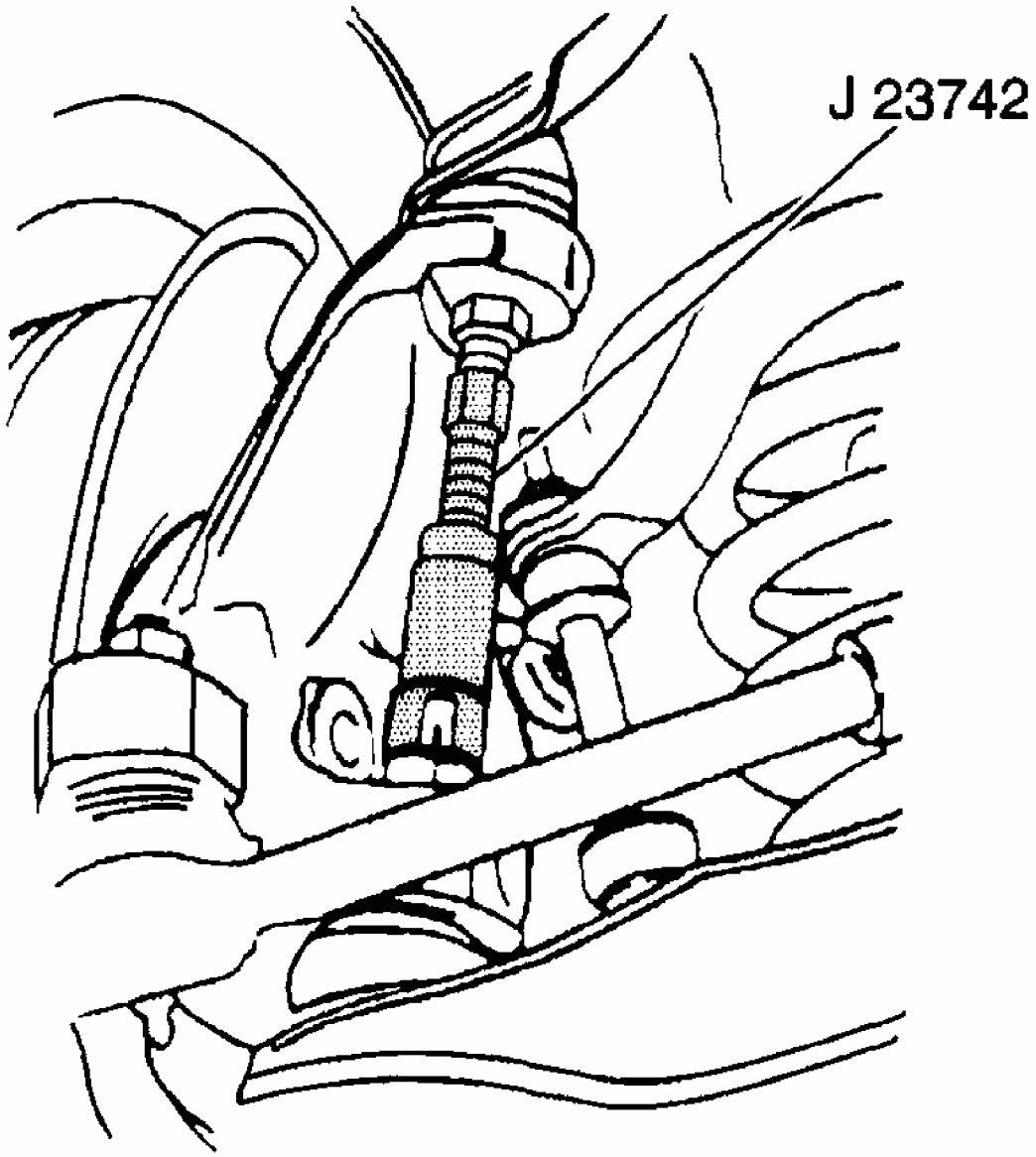

Fig. 15: Separating Ball Joint From Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

13. Remove the rivets from the upper ball joint.
14. Use a 3.175 mm (1/8 in) drill in order to cut a 6.35 mm (1/4 in) deep hole in the center of each rivet.

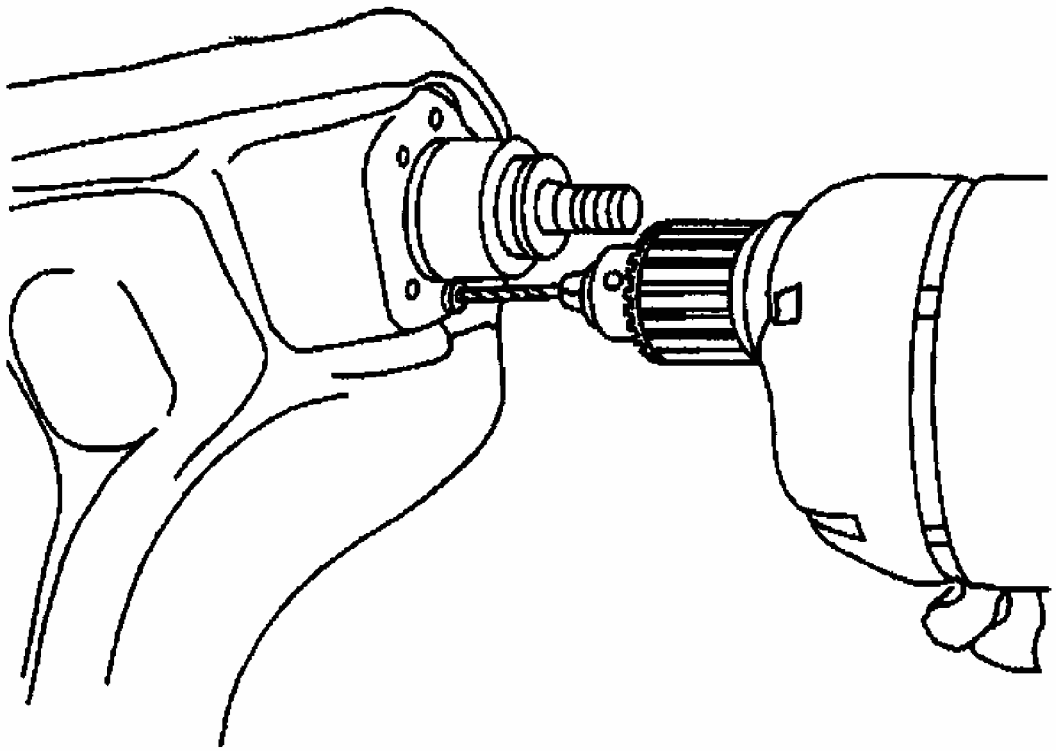

Fig. 16: Cutting Hole In Center Of Rivet
Courtesy of GENERAL MOTORS CORP.

15. Drill away the rivet heads. Use a 12.7 mm (1/2 in) drill.

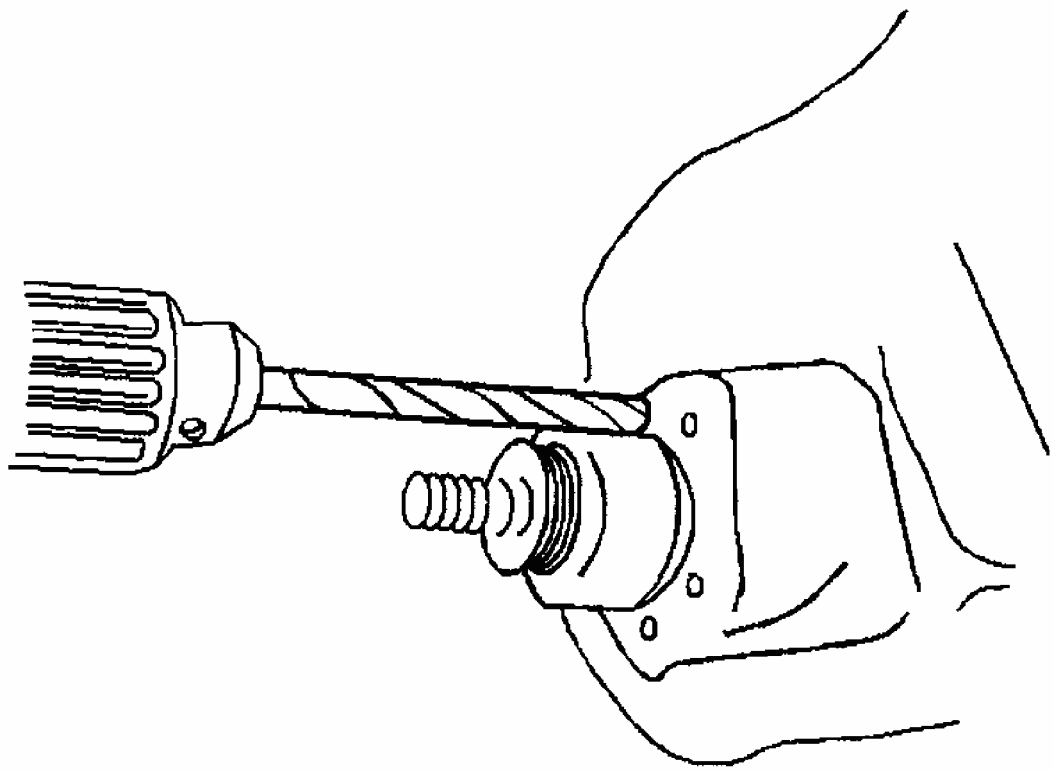

Fig. 17: Drilling Away Rivet Heads
Courtesy of GENERAL MOTORS CORP.

16. Punch the rivets out. Use a small pin punch.

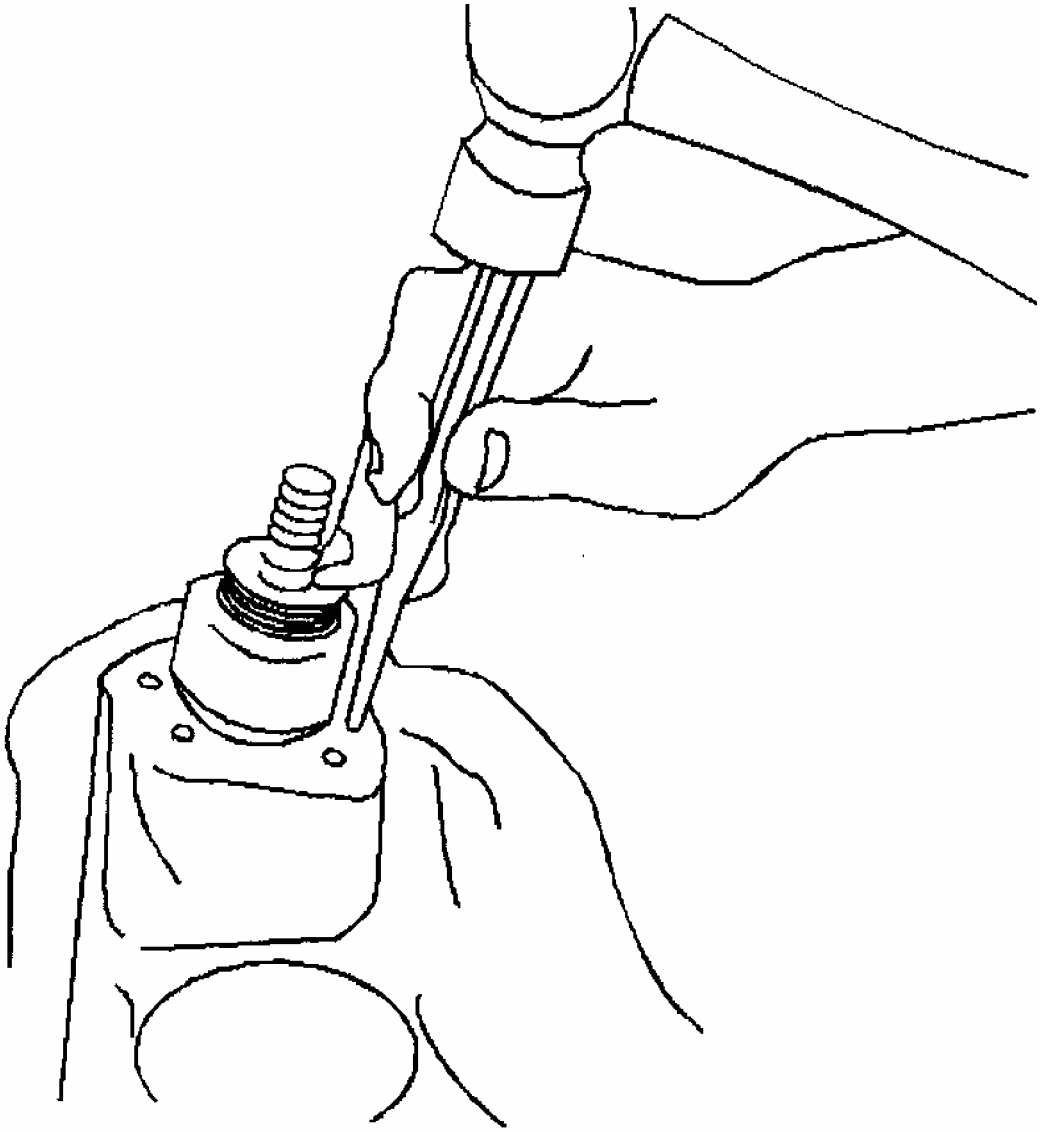

Fig. 18: Punching Rivets Out
Courtesy of GENERAL MOTORS CORP.

17. Remove the upper ball joint.

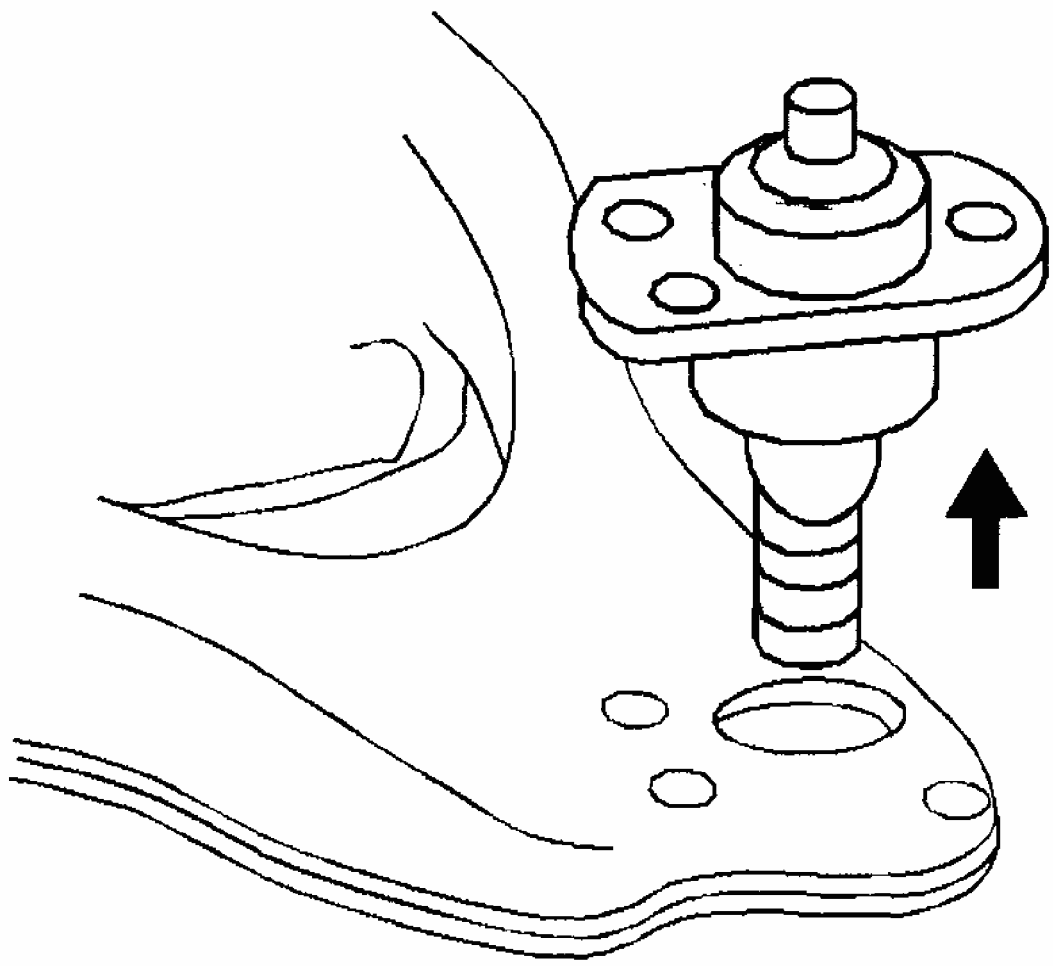

Fig. 19: Upper Ball Joint
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install a new upper ball joint to the upper control arm.

   NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Install the upper ball joint retaining bolts and nuts.

   Tighten

   Tighten the upper ball joint retaining nuts to 23 N.m (17 lb ft).

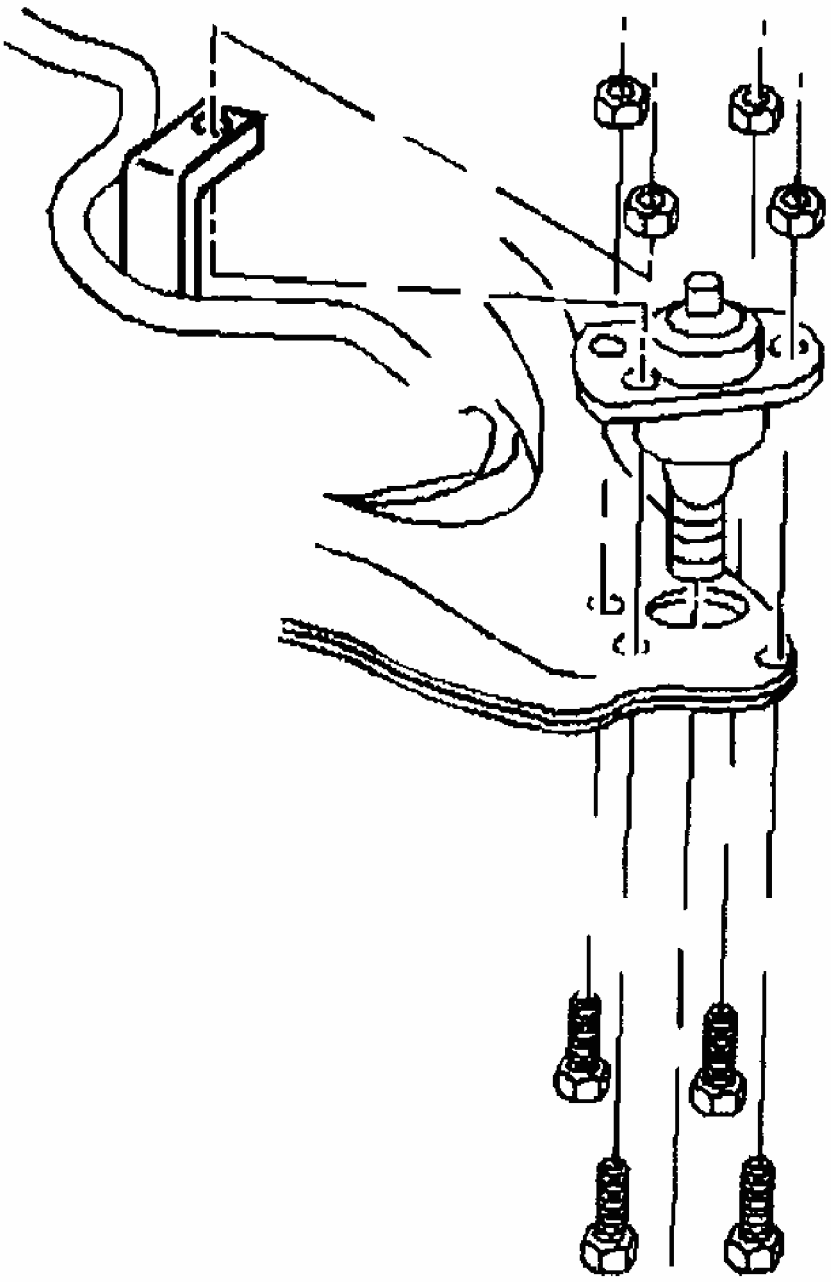

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Fig. 20: Installing Upper Ball Joint To Upper Control Arm
Courtesy of GENERAL MOTORS CORP.

3. Install the upper ball joint to the steering knuckle.
4. Install the upper ball joint stud nut.

Tighten

- Tighten the upper ball joint stud nut to 83 N.m (61 lb ft).
- Tighten the stud nut in order to align the slot in the stud nut with the hole in the stud.

5. Install a new cotter pin.
6. Install the grease fittings.
7. Lubricate the upper ball joint.
8. Connect the wheel speed sensor electrical connector.
9. Install the wheel speed sensor electrical connector to the upper control arm.

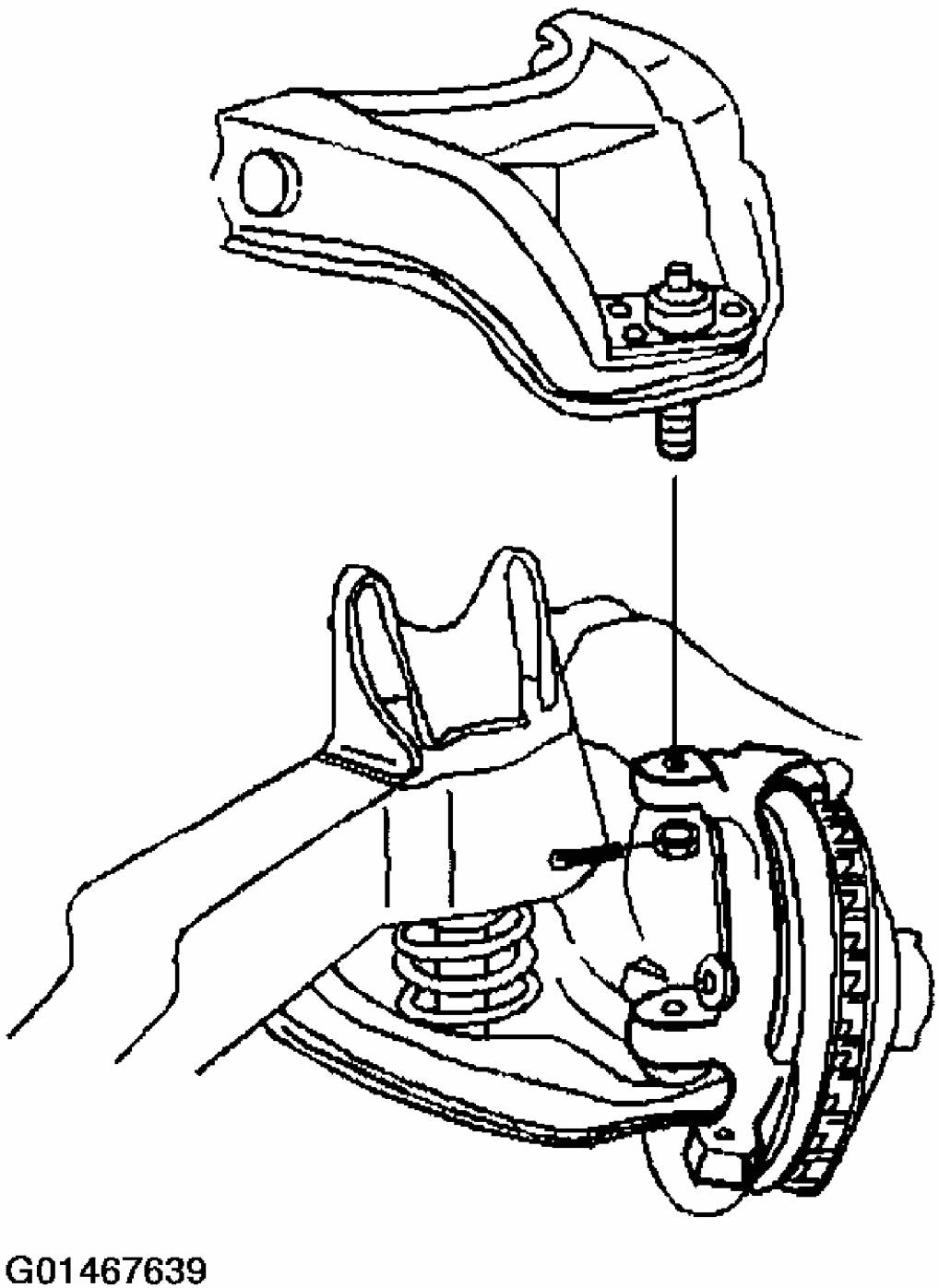

Fig. 21: Installing Upper Ball Joint To Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

10. Install the brake caliper. Refer to **BRAKE CALIPER -- FRONT SINGLE PISTON**

or **BRAKE CALIPER -- FRONT DUAL PISTON** in Disc Brakes.

11. Install the tire and wheel assembly. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
12. Lower the vehicle.
13. Check the front wheel alignment. Refer to **MEASURING WHEEL ALIGNMENT** in Wheel Alignment.

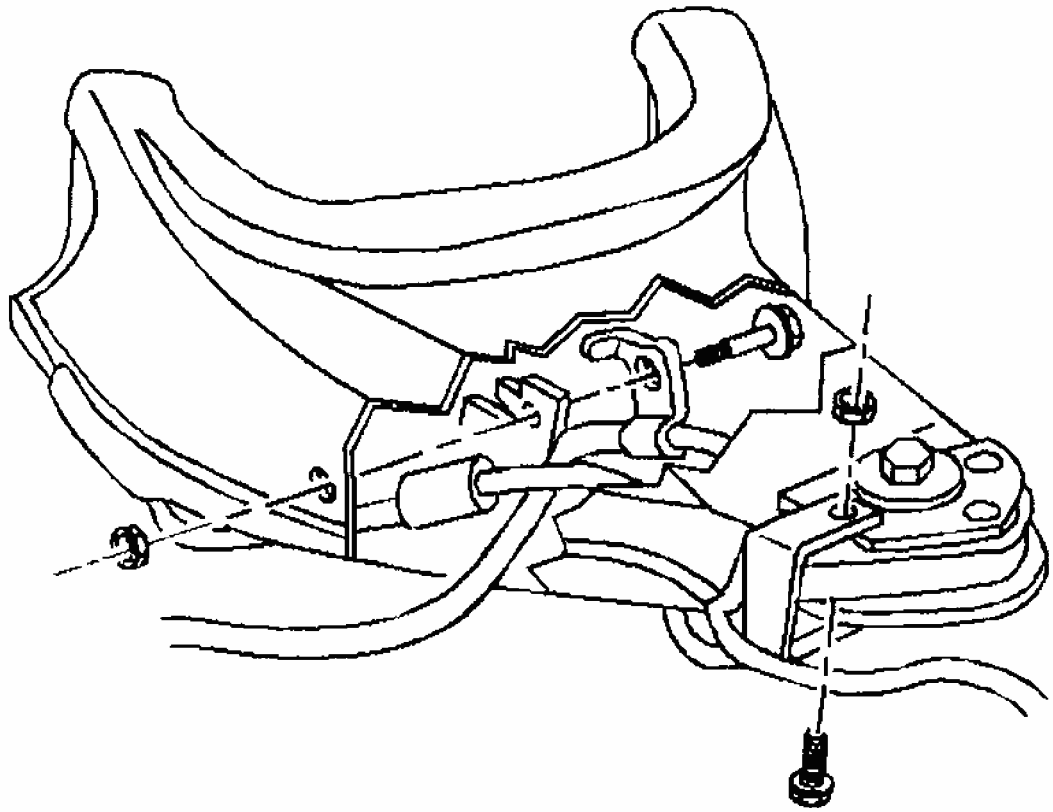

Fig. 22: Disconnecting Wheel Speed Sensor Wiring Harness Bracket & Brake Hose Bracket
Courtesy of GENERAL MOTORS CORP.

UPPER BALL JOINT REPLACEMENT (4WD)

Removal Procedure

CAUTION: Refer to FLOOR JACK CAUTION in Cautions and Notices.

1. Raise and suitably support the vehicle with safety stands. Refer to **LIFTING AND**

JACKING THE VEHICLE in General Information.

2. Remove the tire and wheel. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
3. Unload the torsion bar. Refer to **TORSION BAR AND SUPPORT ASSEMBLY REPLACEMENT** .
4. Remove the wheel speed sensor wiring harness bracket and brake hose bracket mounting bolt and nut from the upper control arm.
5. Disconnect the wheel speed sensor wiring harness bracket and brake hose bracket from the upper control arm.
6. Remove the cotter pin from the upper ball joint retaining nut.
7. Remove the upper ball joint retaining nut.
8. Using a pry bar, placed under the upper control arm and on top of the frame, pry upward.
9. With the aid of a helper, carefully hammer on the steering knuckle in the area of the upper ball joint stud in order to release the stud from the steering knuckle.
10. Remove the upper ball joint from the steering knuckle.

    10.1 Place a block under the upper control arm to keep the control arm and the steering knuckle out of the way.

    10.2 Suspend the steering knuckle to prevent straining the brake line.

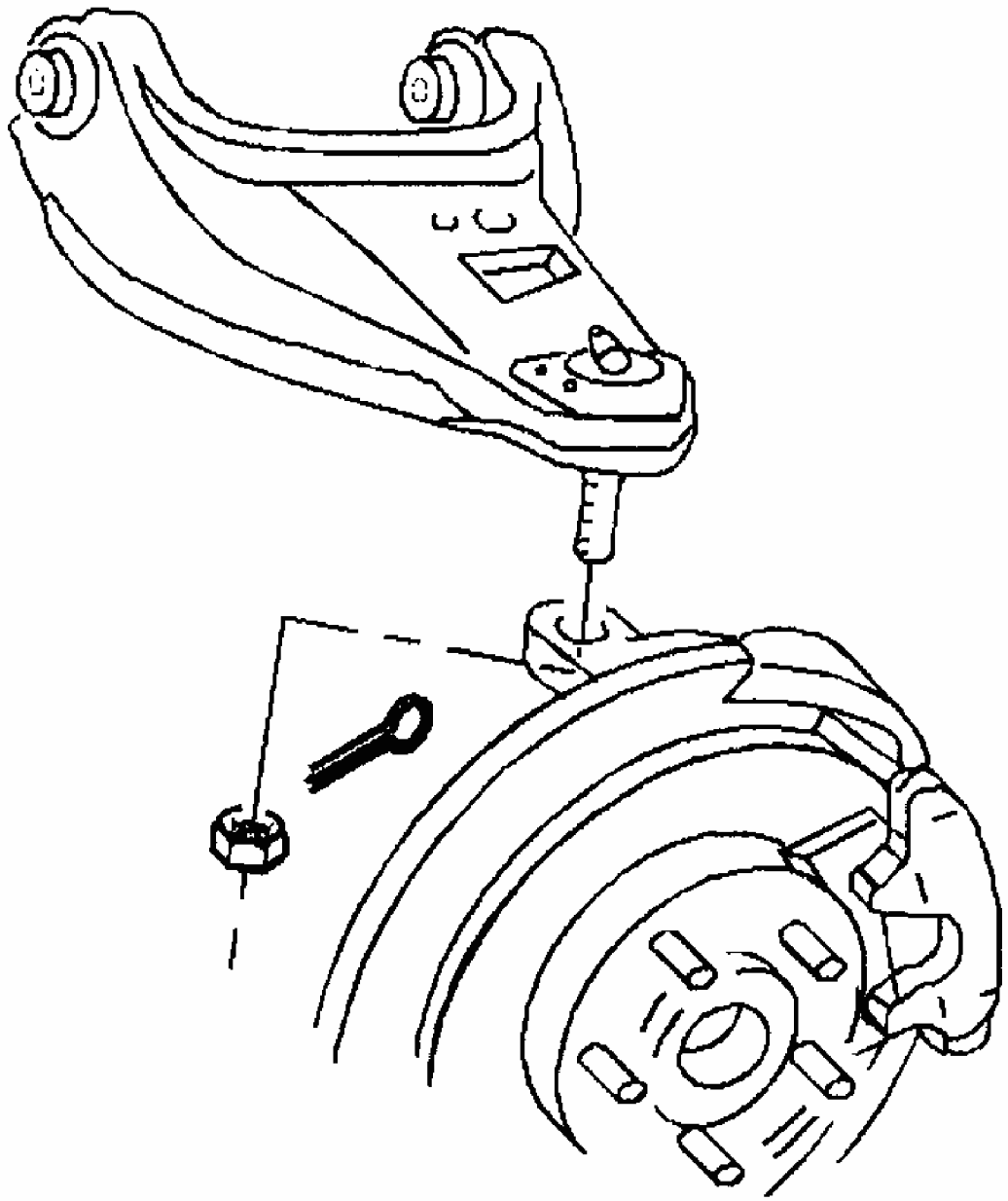

Fig. 23: Removing Upper Ball Joint From Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

11. Remove the rivets from the upper ball joint. Use a 3.175 mm (1/8 in) drill to cut a 6.35 mm (1/4 in) deep hole in the center of each rivet.

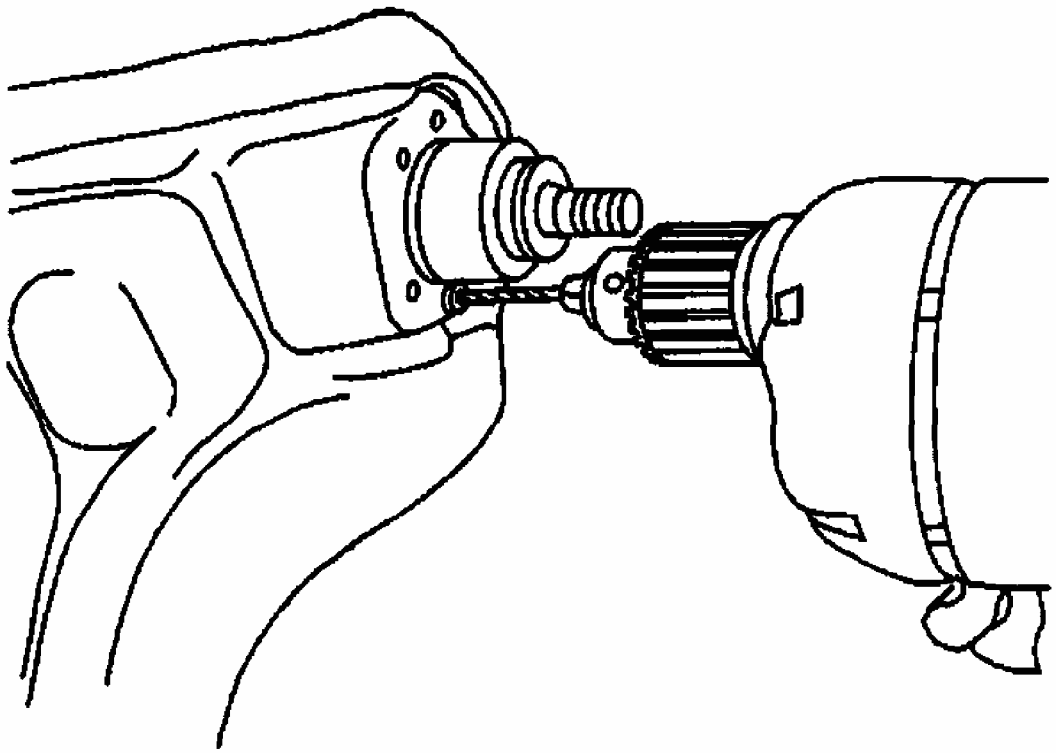

Fig. 24: Cutting Hole In Center Of Rivet
Courtesy of GENERAL MOTORS CORP.

12. Drill the rivet heads away using a 12.7 mm (1/2 in) drill.

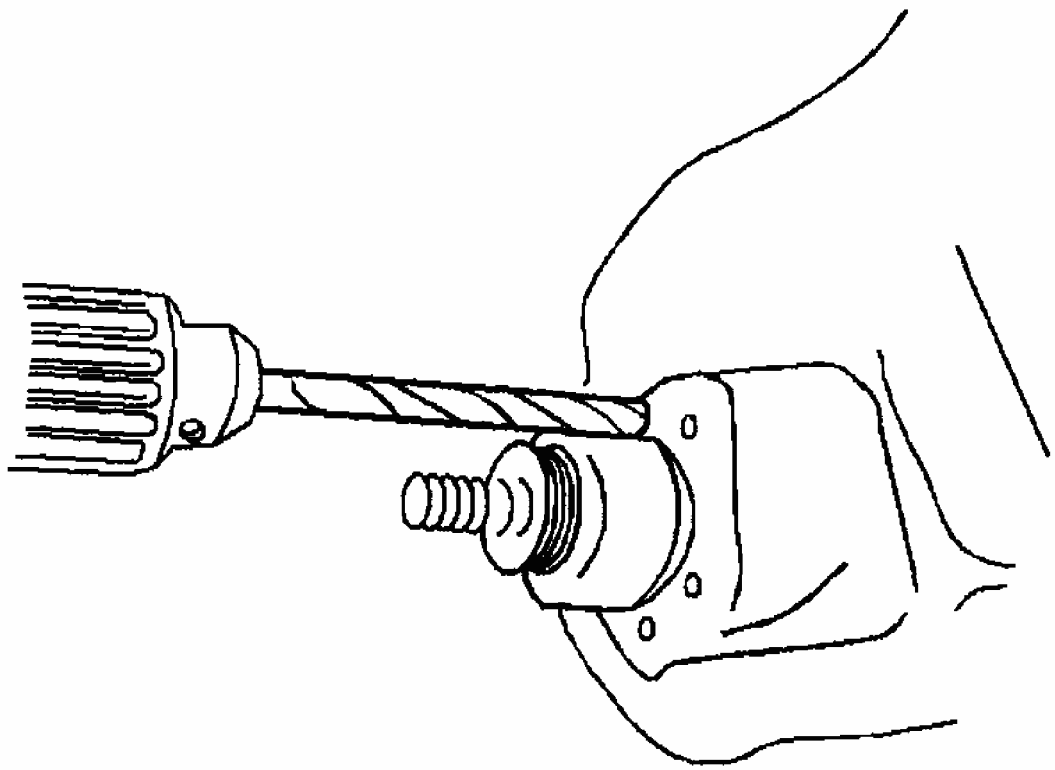

Fig. 25: Drilling Rivet Heads Away
Courtesy of GENERAL MOTORS CORP.

13. Remove the rivets using a pin punch.
14. Remove the upper ball joint.

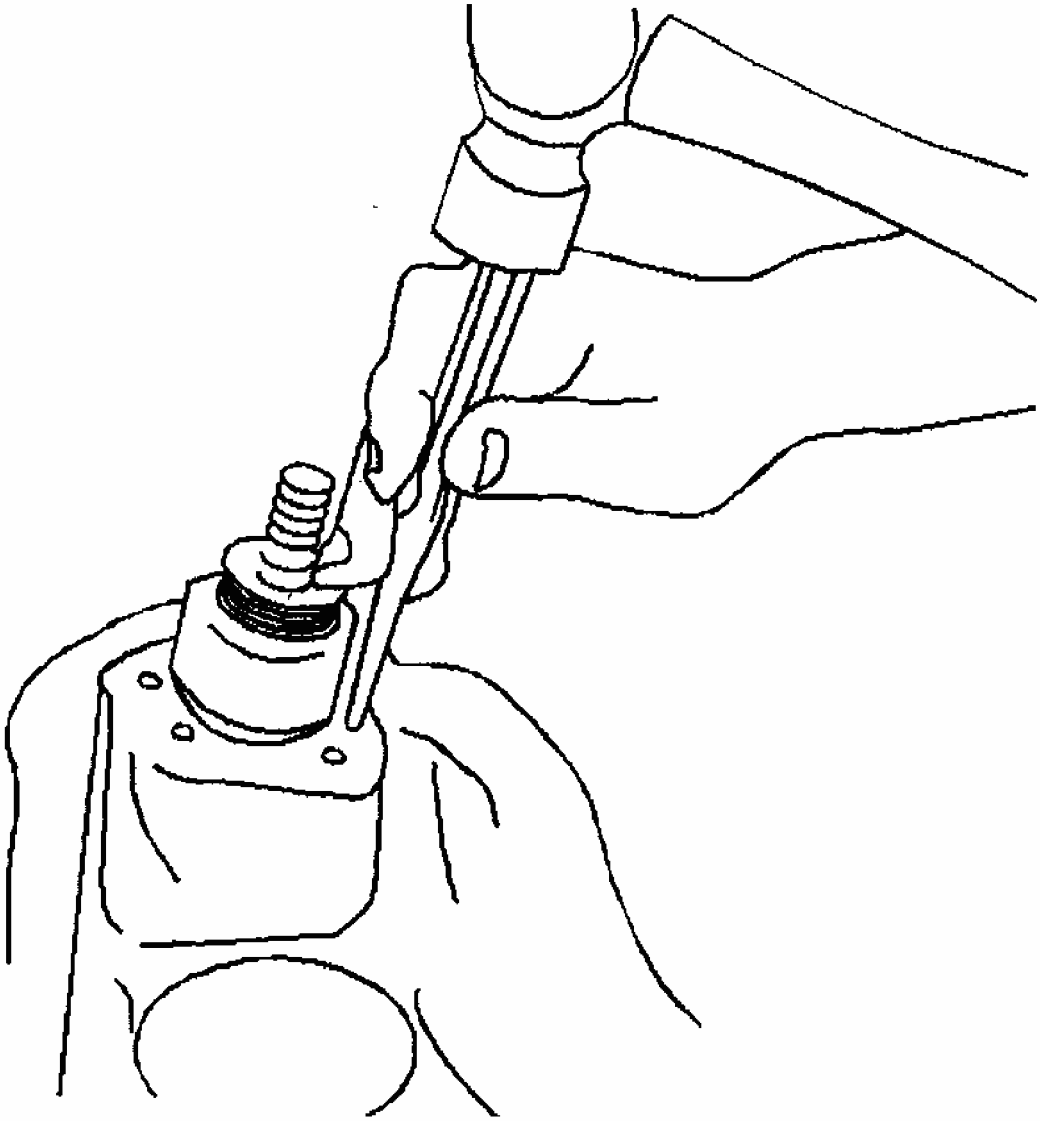

Fig. 26: Removing Rivet Using Pin Punch
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the upper ball joint to the upper control arm.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Install the upper ball joint retaining bolts and the nuts.

Tighten

Tighten the upper ball joint retaining nuts to 23 N.m (17 lb ft).

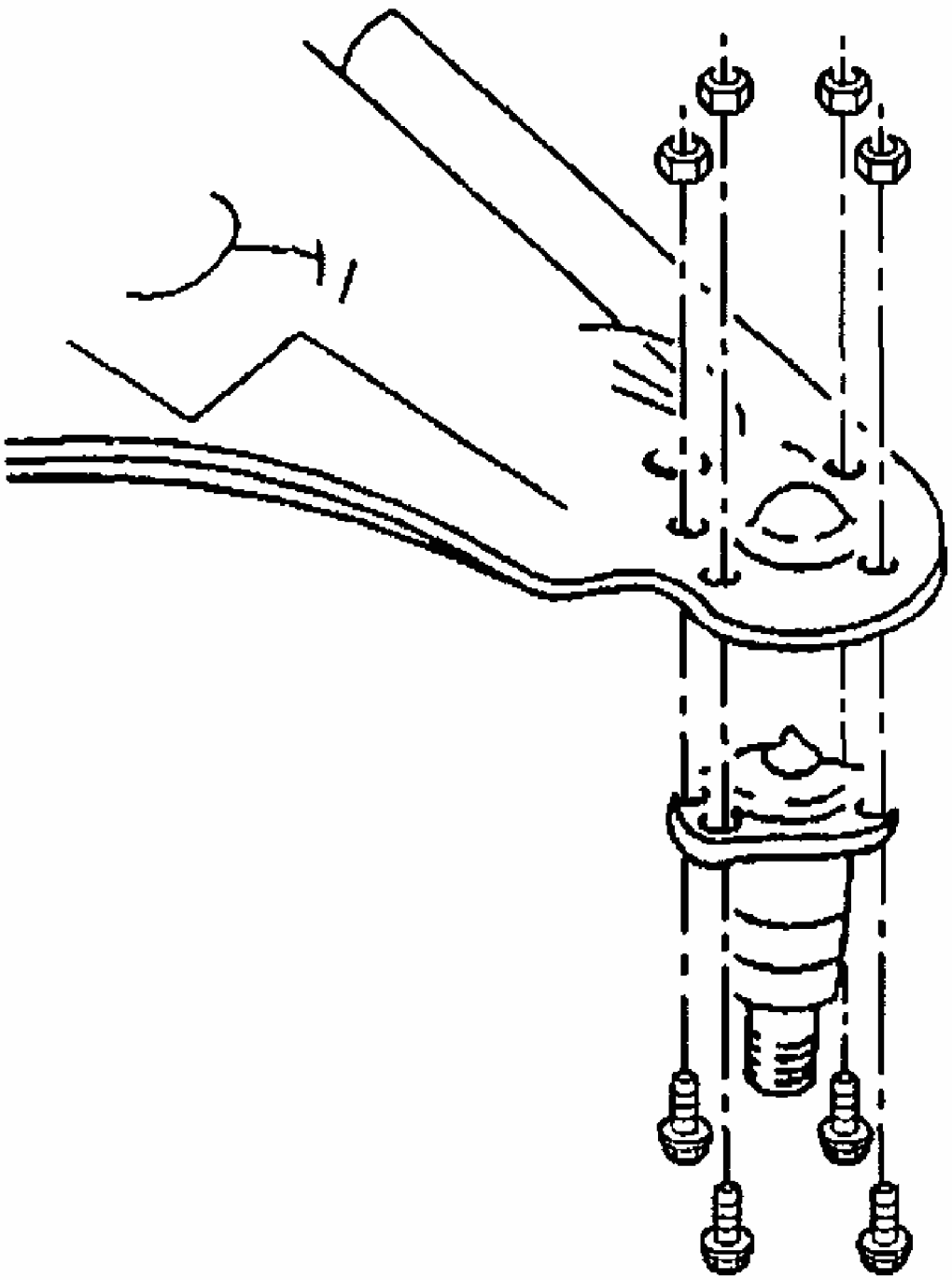

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Fig. 27: Installing Upper Ball Joint To Upper Control Arm
Courtesy of GENERAL MOTORS CORP.

3. Install the upper ball joint to the steering knuckle.
4. Install the upper ball joint to steering knuckle retaining nut.

Tighten

- Tighten the upper ball joint to steering knuckle retaining nut to 83 N.m (61 lb ft).
- Tighten the upper ball joint to steering knuckle retaining nut in order to align for the cotter pin. Do not tighten the nut more than 1/6 turn.

5. Install the new cotter pin to the upper ball joint stud. Bend the pin ends against the nut.

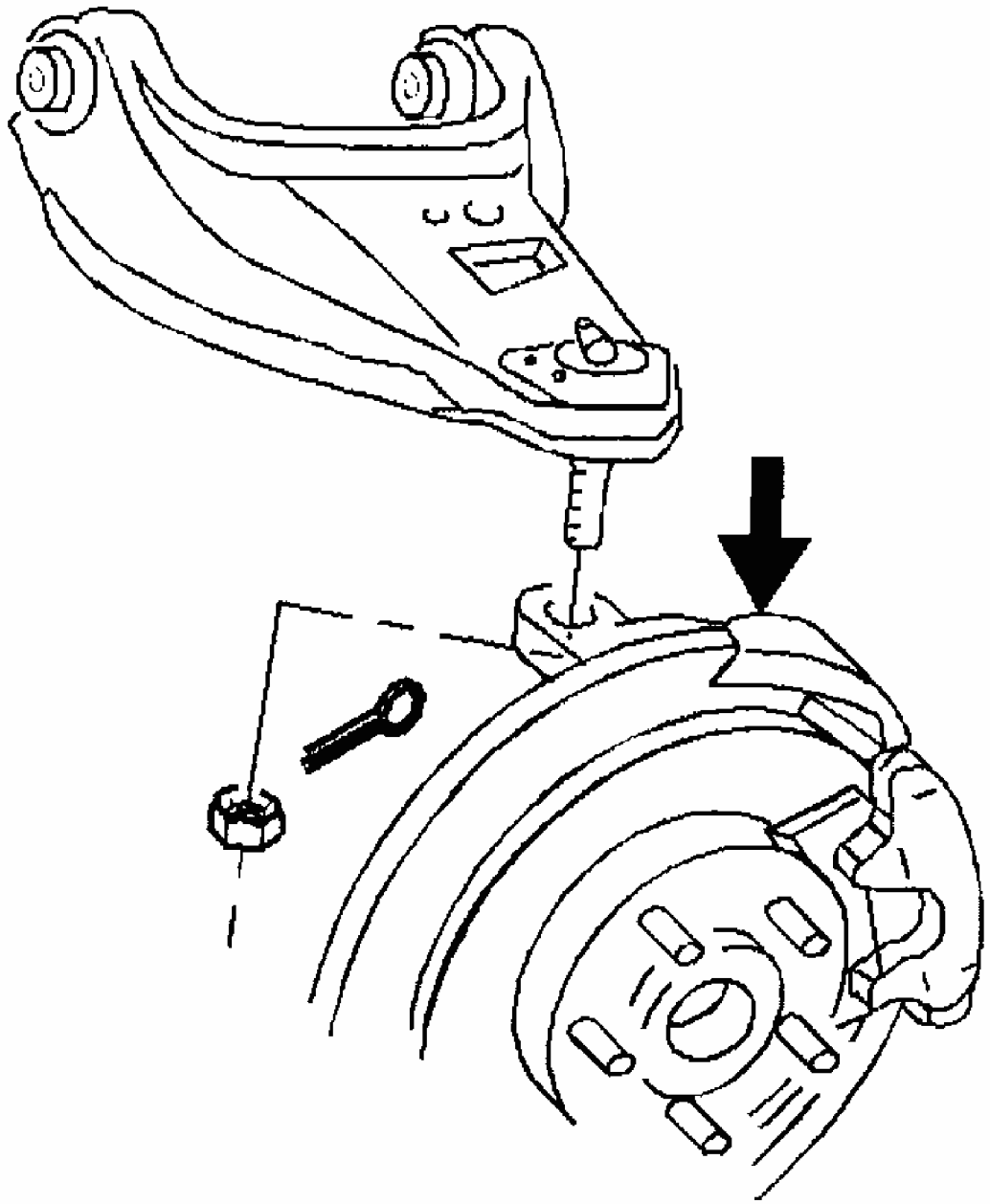

Fig. 28: Installing Upper Ball Joint To Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

6. Connect the wheel speed sensor wiring harness bracket and brake hose bracket to the upper control arm.
7. Install the wheel speed sensor wiring harness bracket and brake hose bracket mounting bolt and nut.

Tighten

Tighten the wheel speed sensor bracket and brake hose bracket mounting nut to 24 N.m (18 lb ft).

8. Load the torsion bar. Refer to **TORSION BAR AND SUPPORT ASSEMBLY REPLACEMENT** .
9. Install the tire and the wheel. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
10. Lower the vehicle.
11. Check the front wheel alignment. Refer to **WHEEL ALIGNMENT SPECIFICATIONS** in Wheel Alignment.

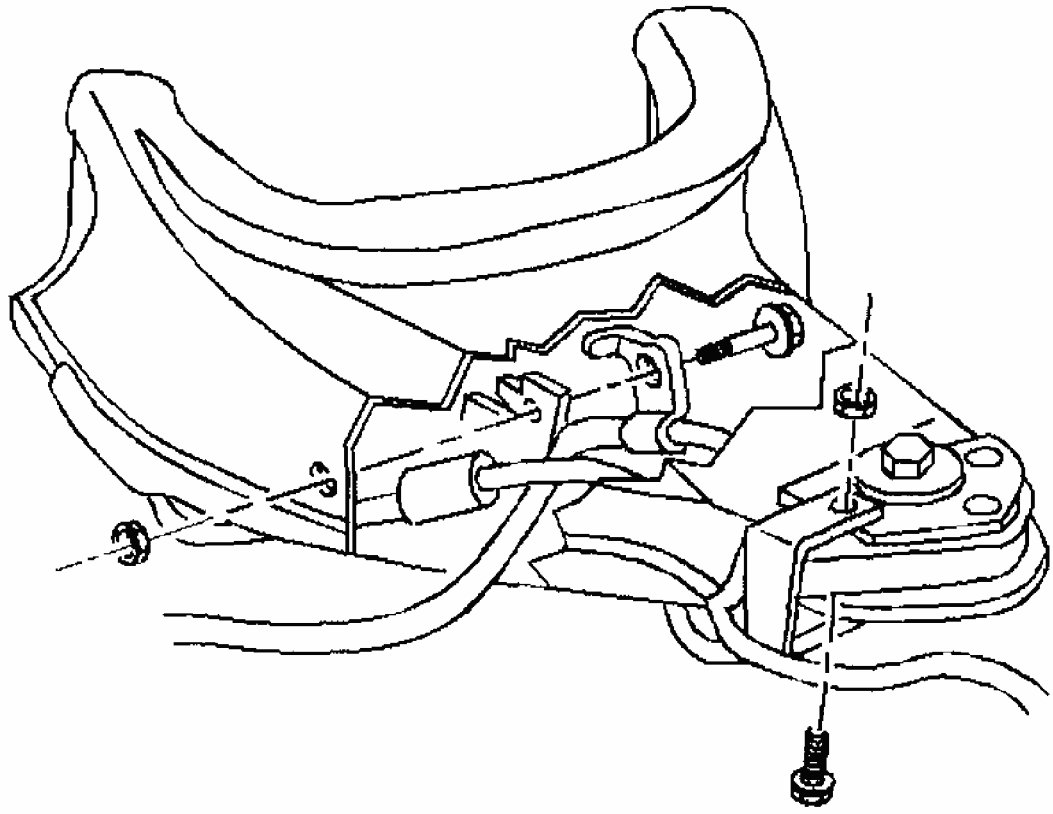

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Fig. 29: Wheel Speed Sensor Wiring Harness Bracket & Brake Hose Bracket
Courtesy of GENERAL MOTORS CORP.

LOWER BALL JOINT REPLACEMENT (RWD)

Tools Required

- *J 23742* Ball Joint Separator
- *J 9519-D* Ball Joint Remover and Installer Set

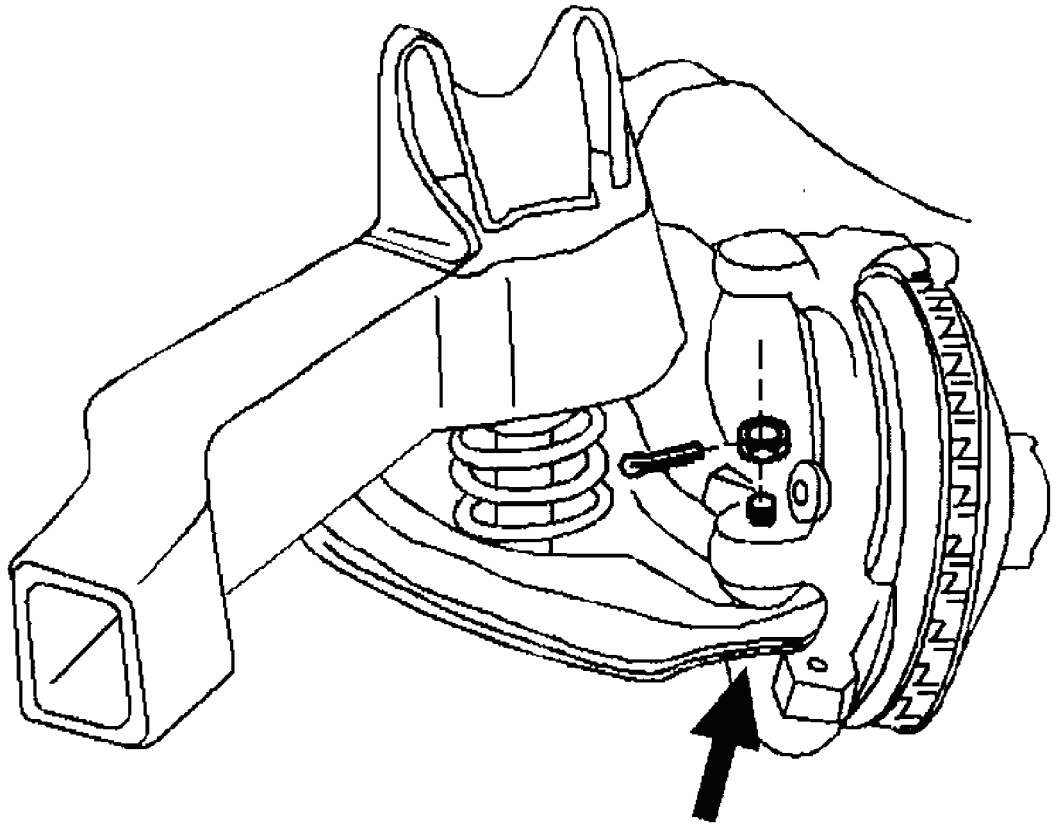

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Fig. 30: Cotter Pin & Nut
Courtesy of GENERAL MOTORS CORP.

Removal Procedure

1. Raise and suitably support the vehicle with safety stands. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the tire and wheel assembly. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.

CAUTION: Refer to FLOOR JACK CAUTION in Cautions and Notices.

3. Place a floor jack under the control arm spring seat. Raise the jack in order to support the control arm.

NOTE: Support the caliper with a piece of wire to prevent damage to the brake line.

4. Remove the brake caliper. Refer to **BRAKE CALIPER -- FRONT SINGLE PISTON** or **BRAKE CALIPER -- FRONT DUAL PISTON** in Disc Brakes.
5. Remove the cotter pin and the nut.
6. Break the ball joint loose from the steering knuckle using the *J 23742* .

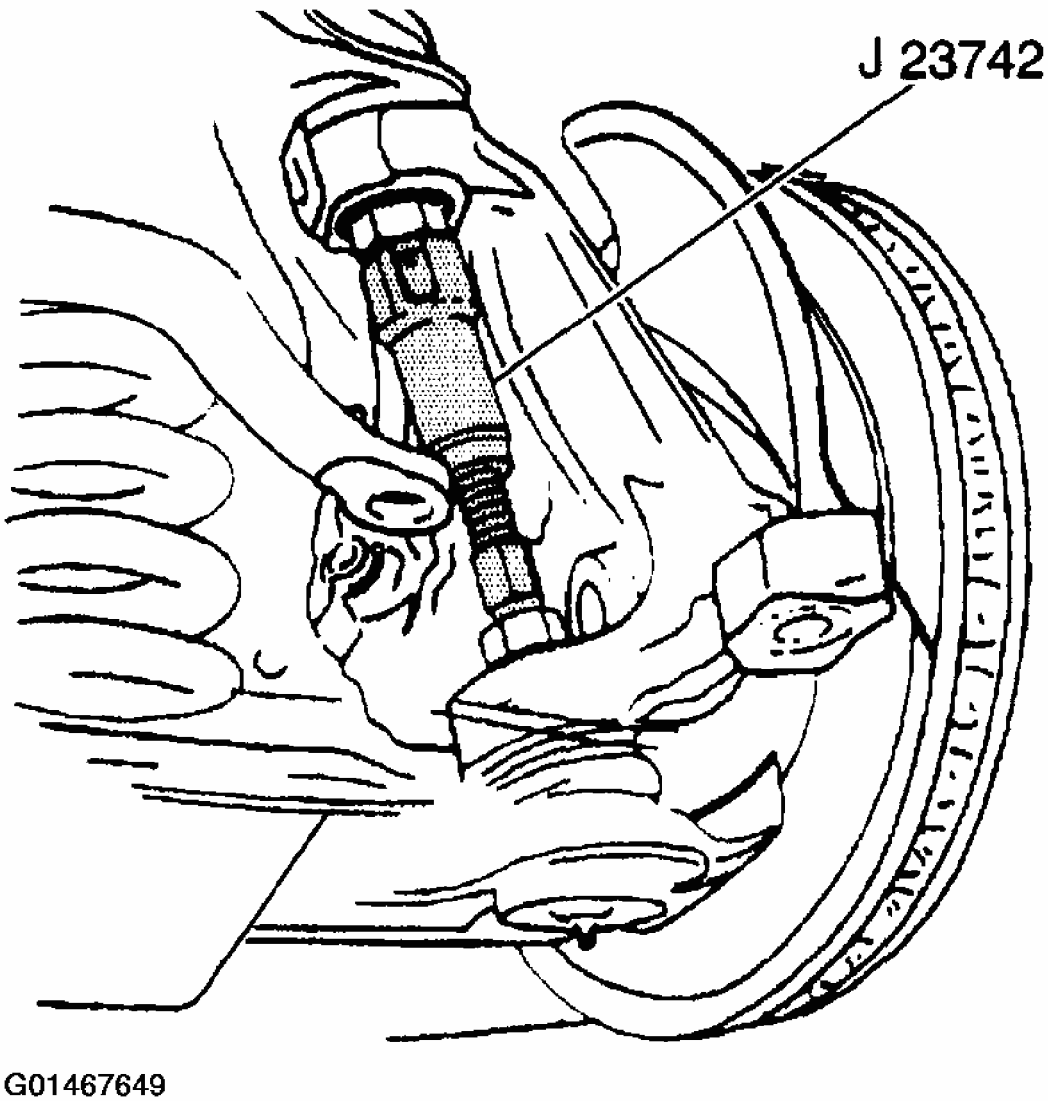

Fig. 31: Breaking Ball Joint Loose From Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

Important: Place a wooden block between the frame and the upper control arm in order to lift the knuckle assembly out of the way.

7. Remove the lower control arm out of the opening in the splash shield. Use a putty knife or a similar tool in order to guide the control arm past the splash shield.

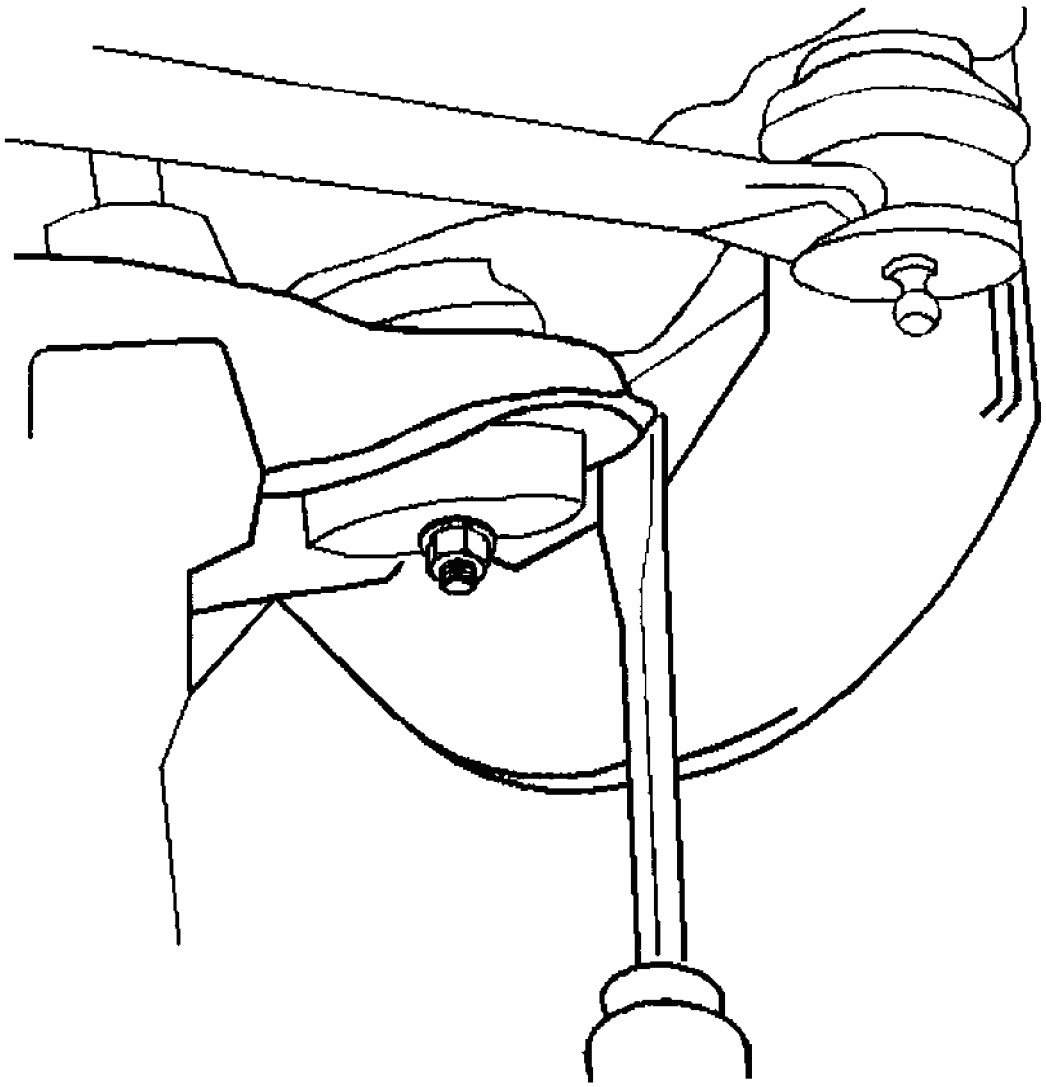

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Fig. 32: Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

8. Remove the lower ball joint from the lower control arm using *J 9519-D* .
9. Inspect the tapered hole in the steering knuckle and remove any dirt. If the tapered hole is out of round, deformed, or damaged, replace the steering knuckle.

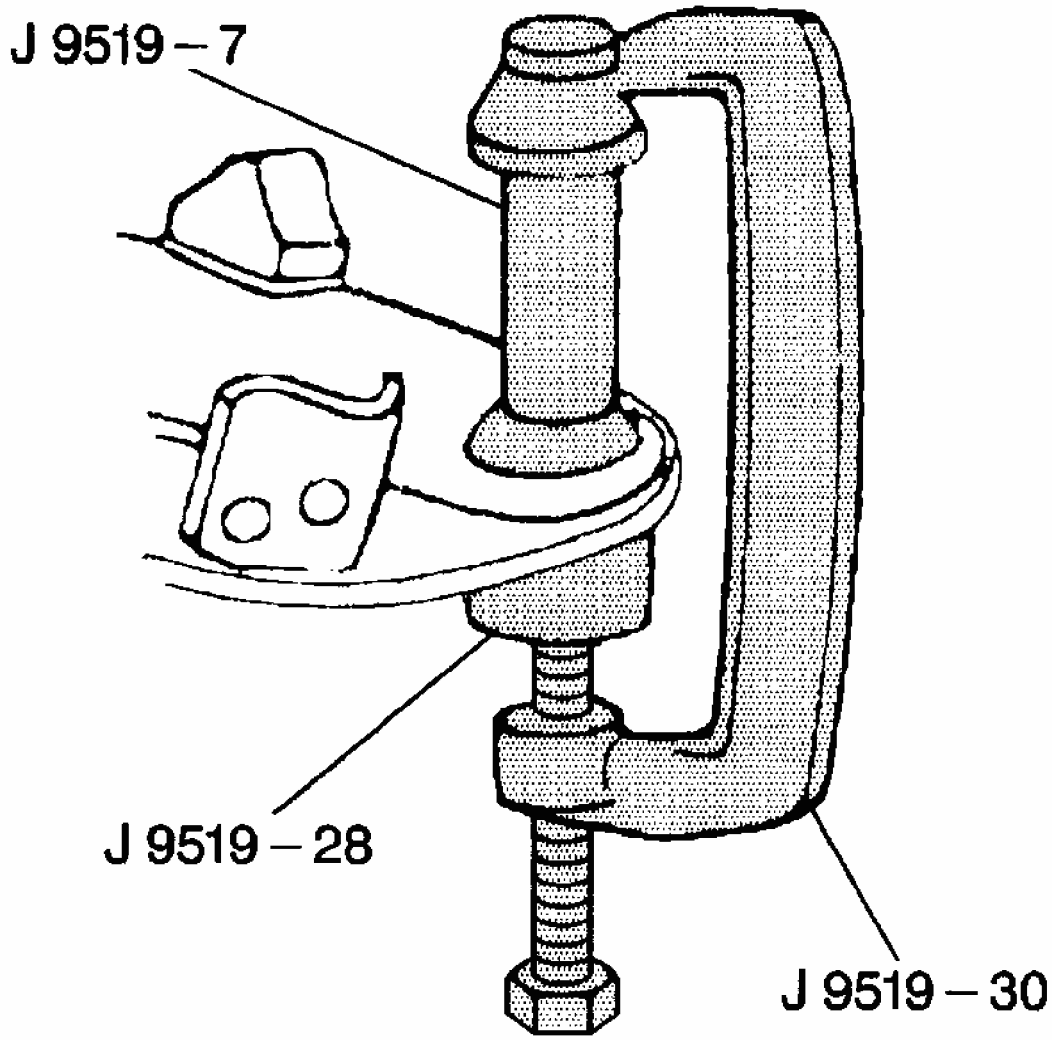

Fig. 33: Removing Lower Ball Joint From Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install a new ball joint into the lower control arm.
   1.1 Press in the ball joint using *J 9519-D* . The ball joint will bottom on the control arm.
   1.2 Locate the grease fitting facing inboard.

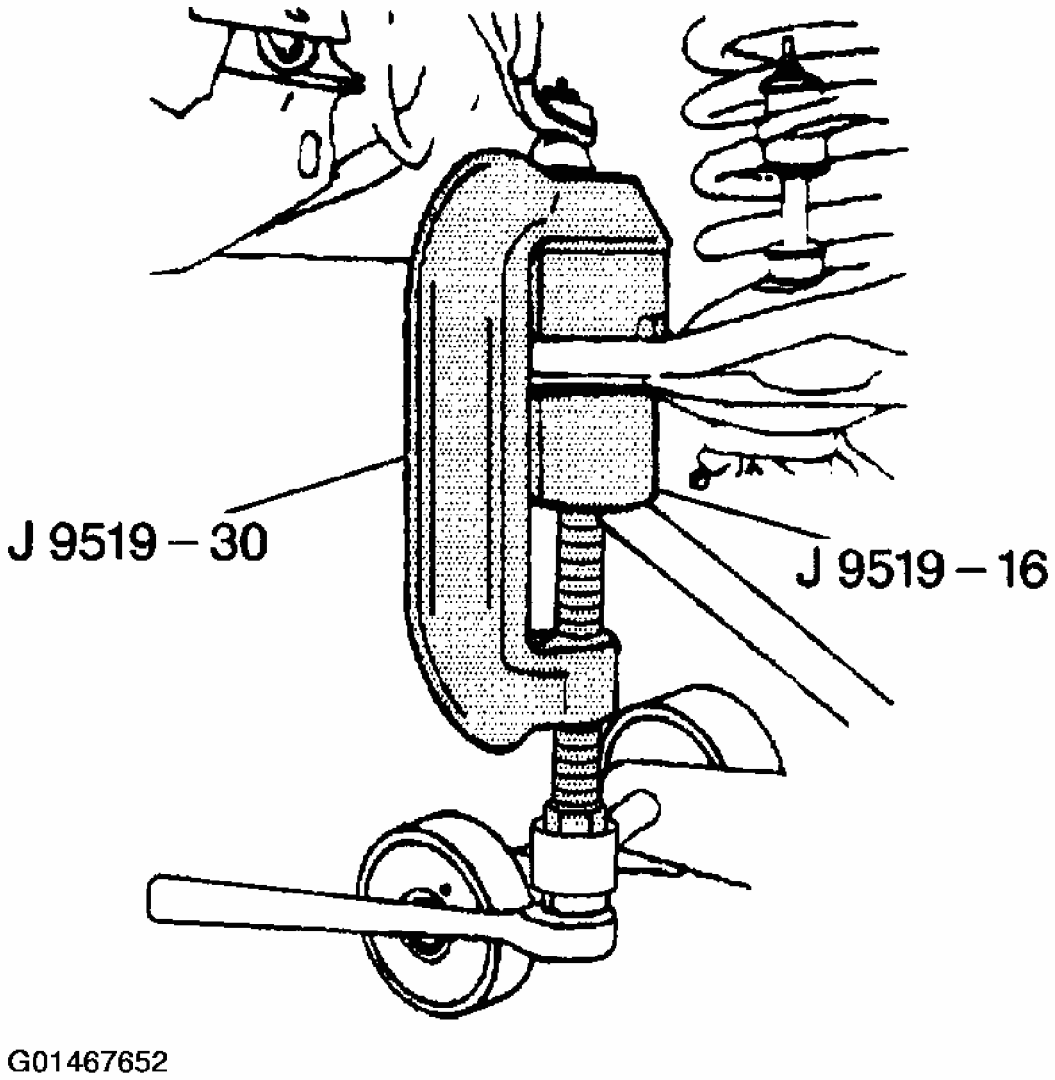

Fig. 34: Installing Ball Joint Into Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

2. Install the ball joint stud into the steering knuckle.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

3. Install the lower ball stud nut.

Tighten

Tighten the lower ball stud nut to 108 N.m (79 lb ft).
Tighten in order to align the slot in the stud nut with the hole in the stud.

4. Install a new cotter pin to the stud.
5. Lubricate the lower ball joint.
6. Install the brake caliper. Refer to **BRAKE CALIPER -- FRONT SINGLE PISTON** or **BRAKE CALIPER -- FRONT DUAL PISTON** in Disc Brakes.
7. Install the tire and wheel assembly. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
8. Lower the vehicle.
9. Check the front wheel alignment. Refer to **MEASURING WHEEL ALIGNMENT** in Wheel Alignment.

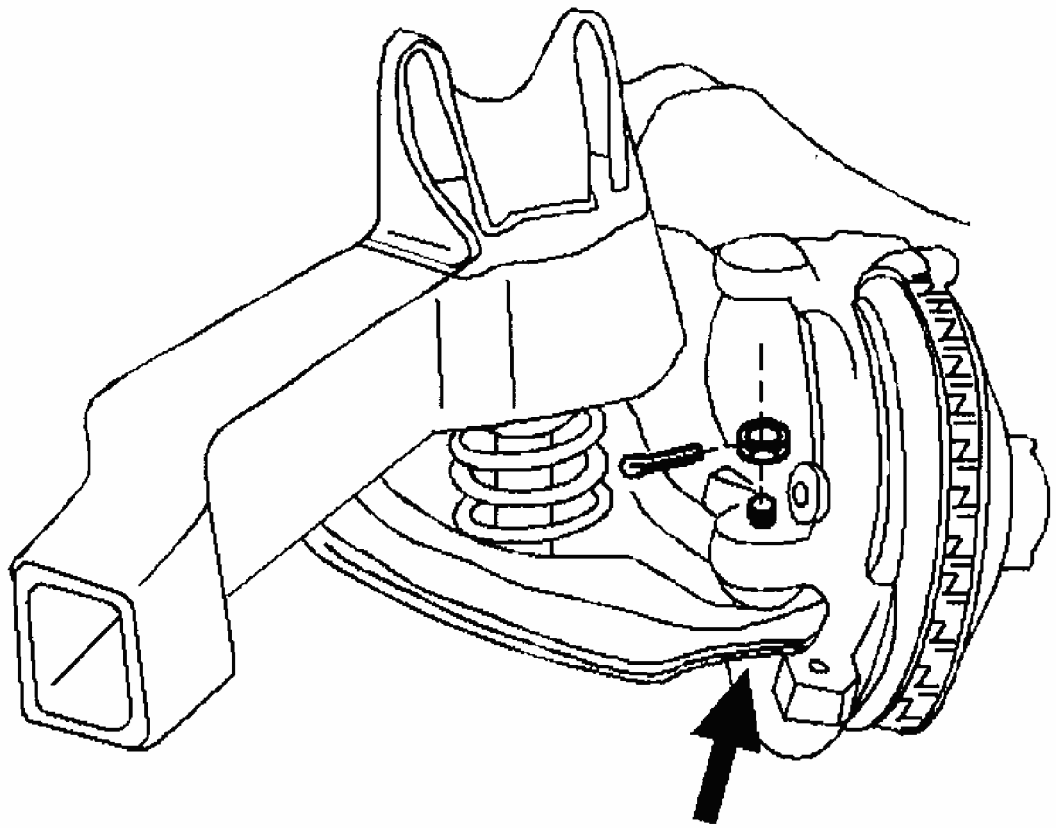

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Fig. 35: Installing Ball Joint Stud Into Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

LOWER BALL JOINT REPLACEMENT (4WD)

Removal Procedure

1. Raise and support the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE**

in General Information.

2. Remove the tire and wheel. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
3. Unload the torsion bar. Refer to **TORSION BAR AND SUPPORT ASSEMBLY REPLACEMENT** .
4. Remove the wheel drive shaft. Refer to WHEEL DRIVE SHAFT REPLACEMENT in Wheel Drive Shafts.
5. Drill a pilot hole in the lower ball joint rivets using a 3.175 mm (1/8 in) drill to cut a 6.35 mm (1/4 in) deep hole in the center of each rivet.

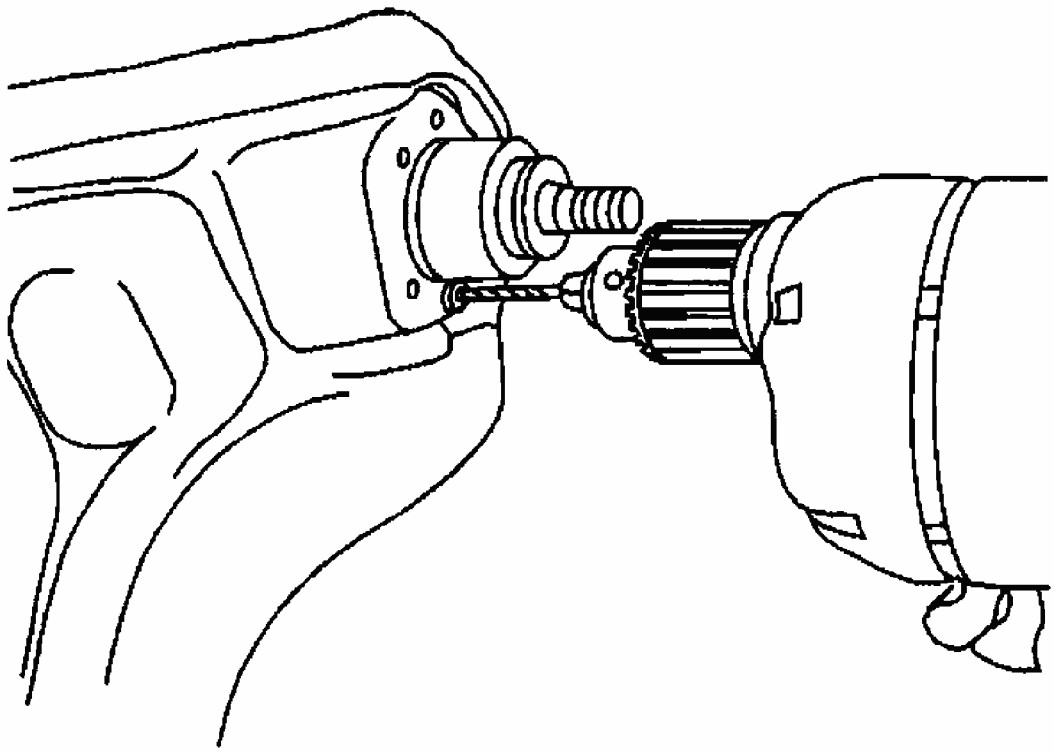

Fig. 36: Drilling Hole In Lower Ball Joint Rivet
Courtesy of GENERAL MOTORS CORP.

6. Drill the rivet heads away using a 12.7 mm (1/2 in) drill.

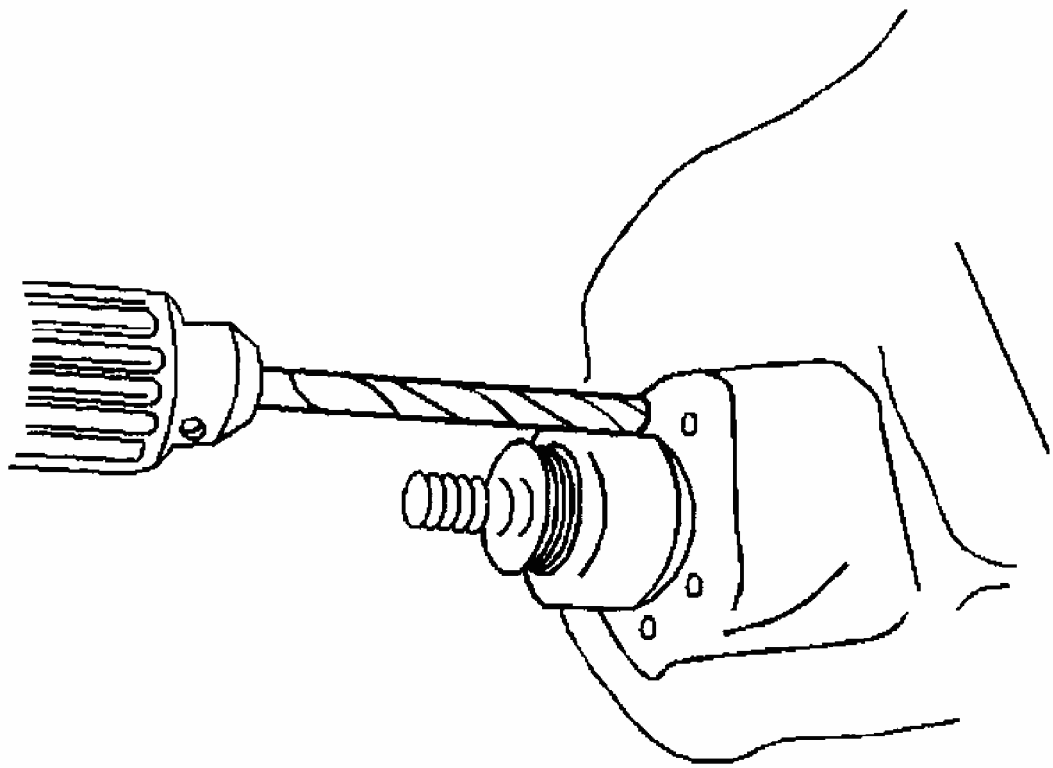

Fig. 37: Drilling Rivet Heads Away
Courtesy of GENERAL MOTORS CORP.

7. Remove the rivets using a pin punch.
8. Remove the lower ball joint from lower control arm.

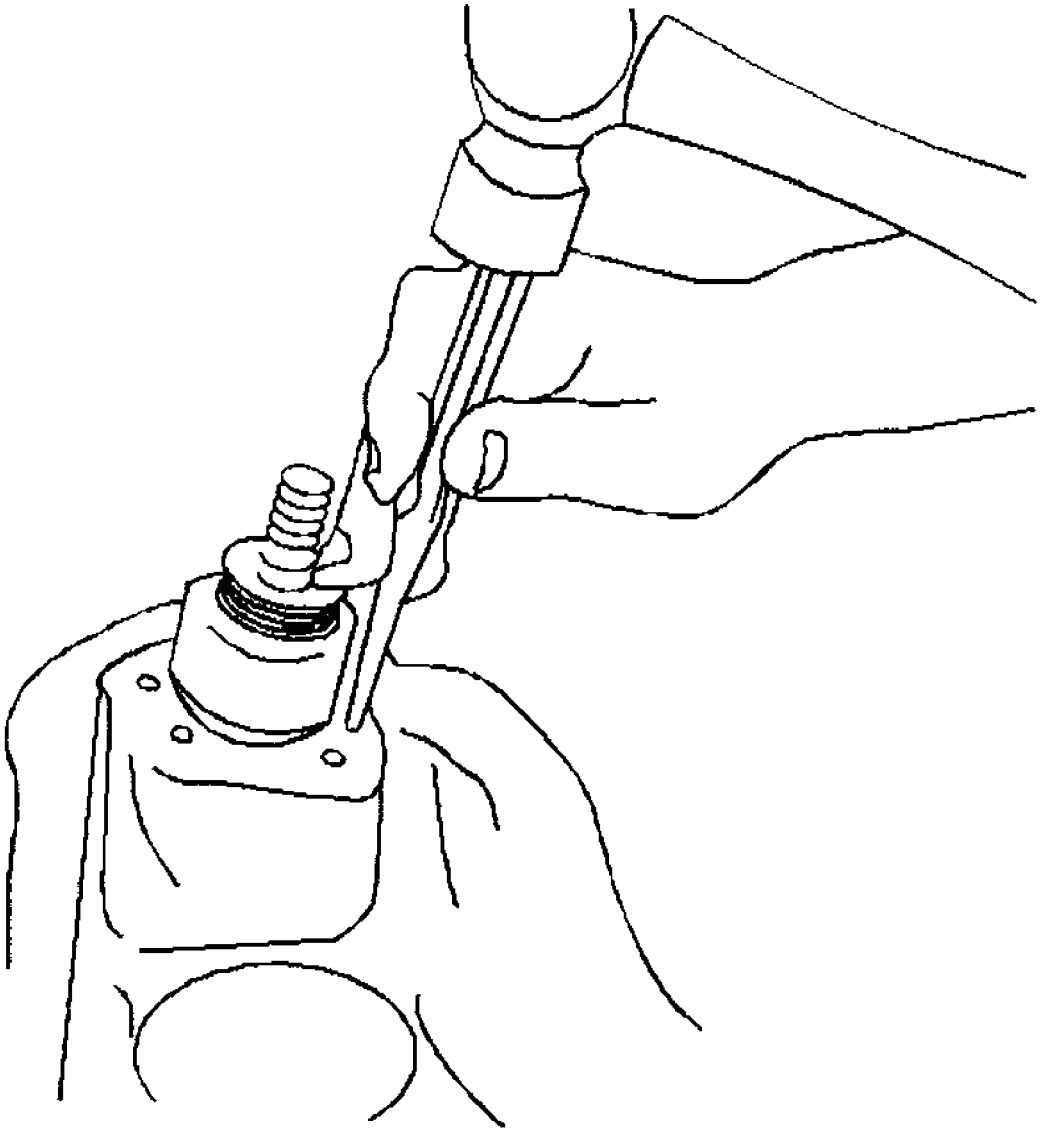

Fig. 38: Removing Rivets Using Pin Punch
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the lower ball joint to the lower control arm.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Install the lower ball joint retaining bolts and the nuts.

Tighten

Tighten the lower ball joint retaining nuts to 23 N.m (17 lb ft).

3. Install the wheel drive shaft. Refer to WHEEL DRIVE SHAFT REPLACEMENT in Wheel Drive Shafts.
4. Load the torsion bar. Refer to **TORSION BAR AND SUPPORT ASSEMBLY REPLACEMENT** .
5. Install the tire and the wheel. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.

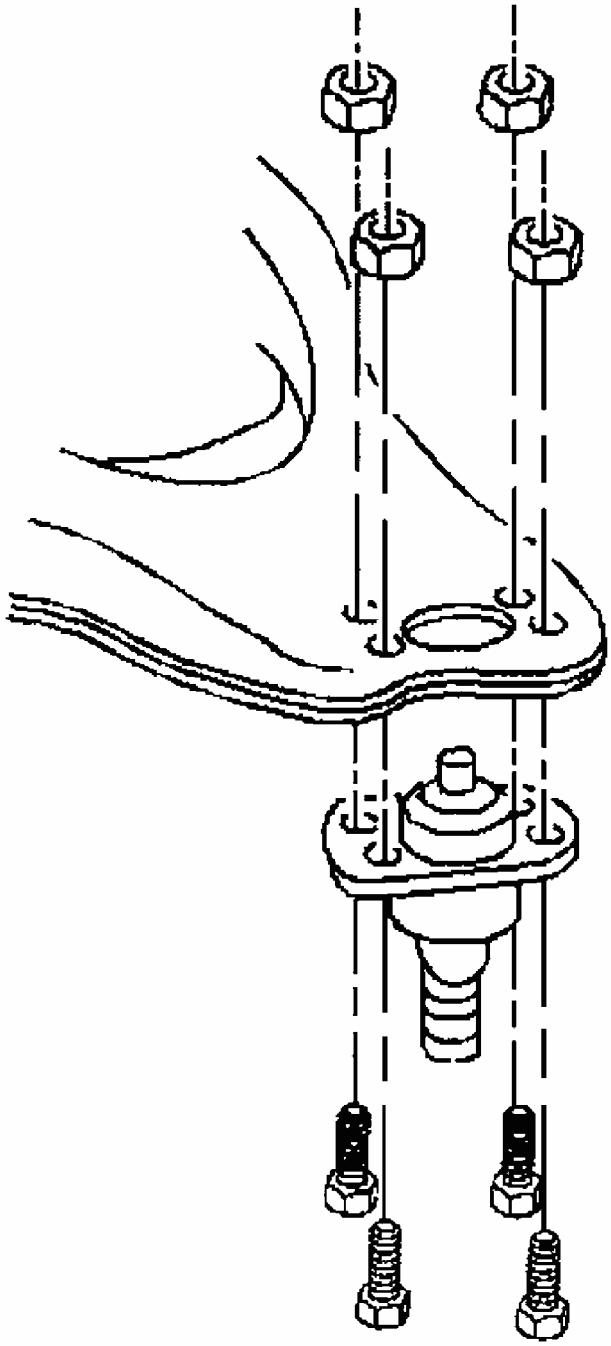

Fig. 39: Installing Lower Ball Joint To Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

6. Lower the vehicle.
7. Check the front wheel alignment. Refer to **MEASURING WHEEL ALIGNMENT** in Wheel Alignment.

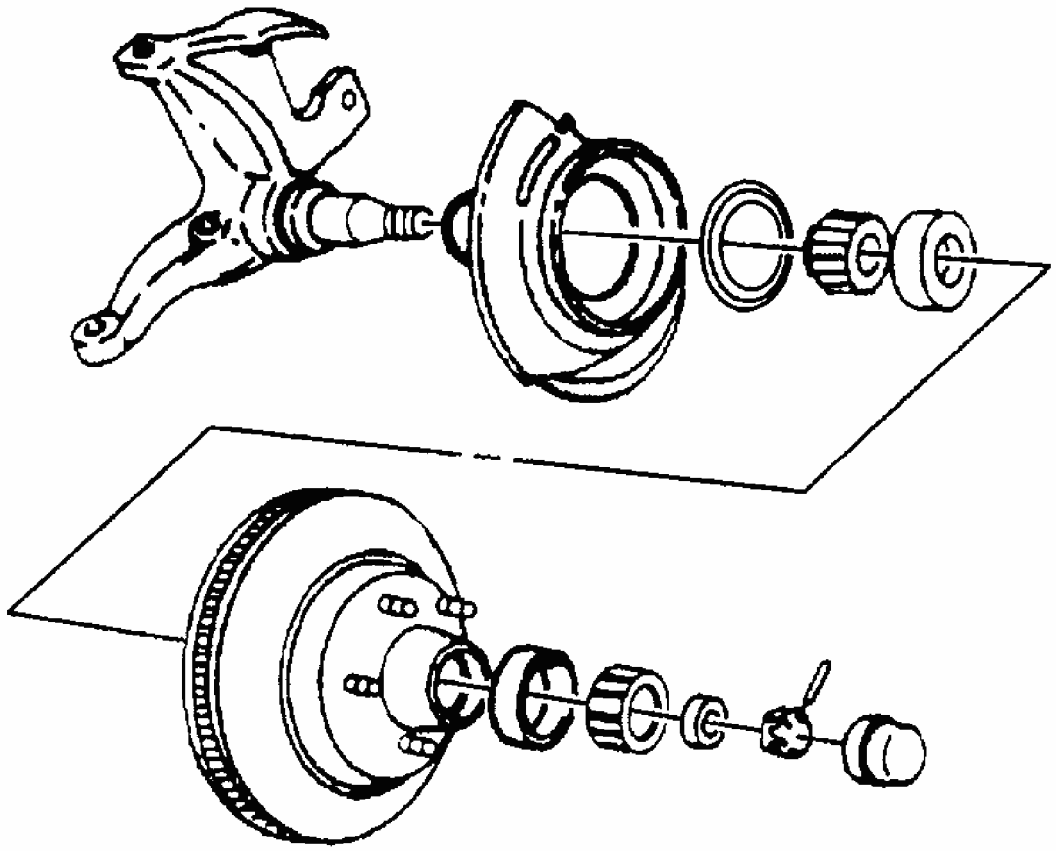

Fig. 40: Adjusting Front Wheel Bearings
Courtesy of GENERAL MOTORS CORP.

WHEEL BEARING ADJUSTMENT

Important:

- Adjust the front wheel bearings correctly in order to ensure the front suspension functions properly.
- The bearings must be a slip fit on the spindle.
- Lubricate the bearings in order to ensure the bearings will creep.
- The spindle nut must have a free-running fit on the spindle threads.

1. Raise and suitably support the vehicle with safety stands. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the wheel cover.
3. Remove the dust cap from the wheel hub.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

4. Remove the cotter pin.

   Tighten

   Tighten the wheel hub nut to 16 N.m (12 lb ft), while turning the wheel forward by hand. This will seat the bearings.

   Important: Do not back the nut off more than 1/2 flat.

5. Adjust the nut to a finger tight position by hand. Then, back the nut off until the hole in the spindle aligns with a slot in the nut.
6. Install a new cotter pin.
   6.1 Make sure the cotter pin ends do not interfere with the cap. Bend the ends of the cotter pin against the nut. Cut off any extra pin length.
   6.2 Measure the endplay. Proper endplay is 0.03-0.13 mm (0.001-0.005 in).
7. Install the dust cap to the wheel hub.
8. Install the wheel cover.
9. Lower the vehicle.

STEERING KNUCKLE REPLACEMENT (RWD)

Tools Required

- *J 23742* Ball Joint Separator
- *J 24319-B* Steering Linkage and Tie Rod Puller
- *J 29193* Steering Linkage Installer

Removal Procedure

CAUTION: Refer to FLOOR JACK CAUTION in Cautions and Notices.

1. Raise the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
   - Support the lower control arm with floor stands.
   - Place floor stands under the lower control arms as far outboard as possible (between spring seats and ball joint) to maintain maximum leverage.

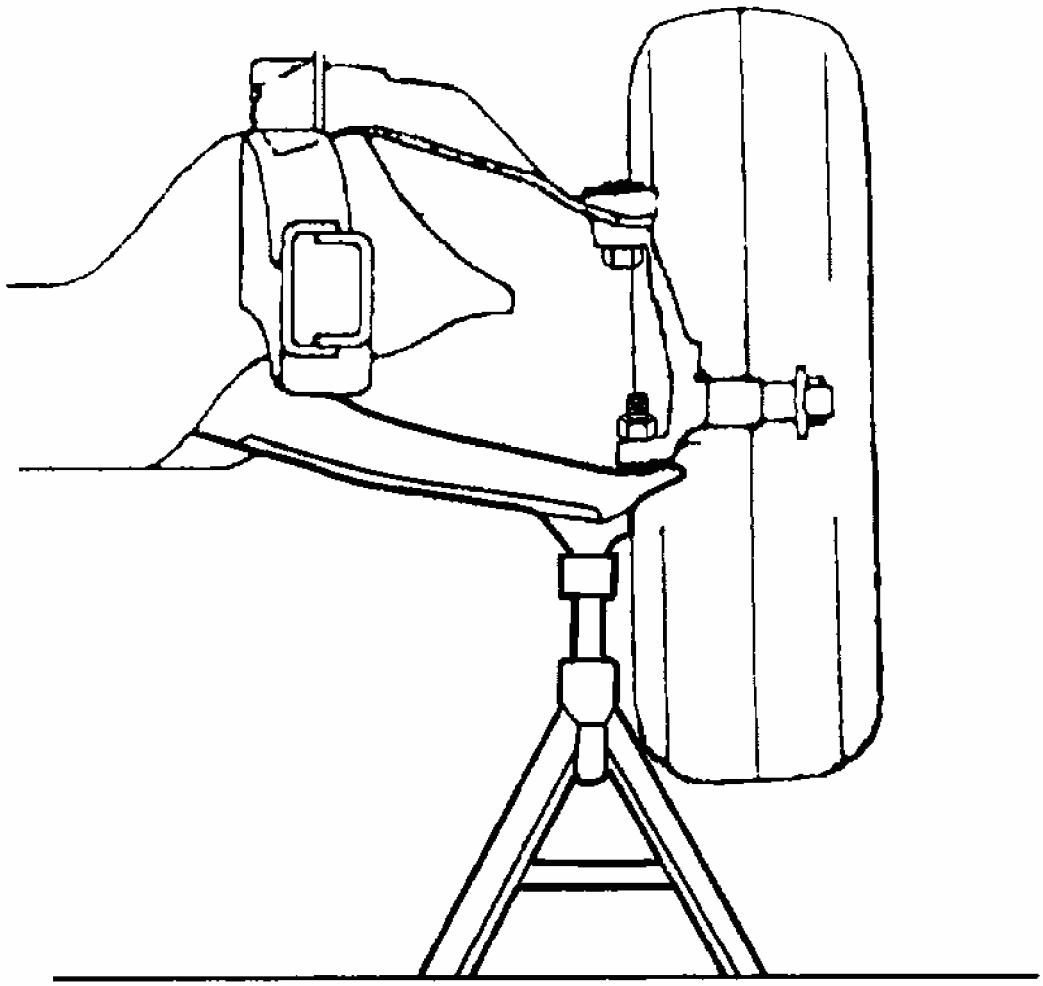

Fig. 41: Supporting Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

2. Remove the wheel hub and bearing. Refer to **WHEEL HUB, BEARING, AND SEAL REPLACEMENT (RWD PICKUP)** or **WHEEL HUB, BEARING, AND SEAL REPLACEMENT (4WD PICKUP AND UTILITIES)** .
3. Remove the bolts that attach the splash shield to the steering knuckle.

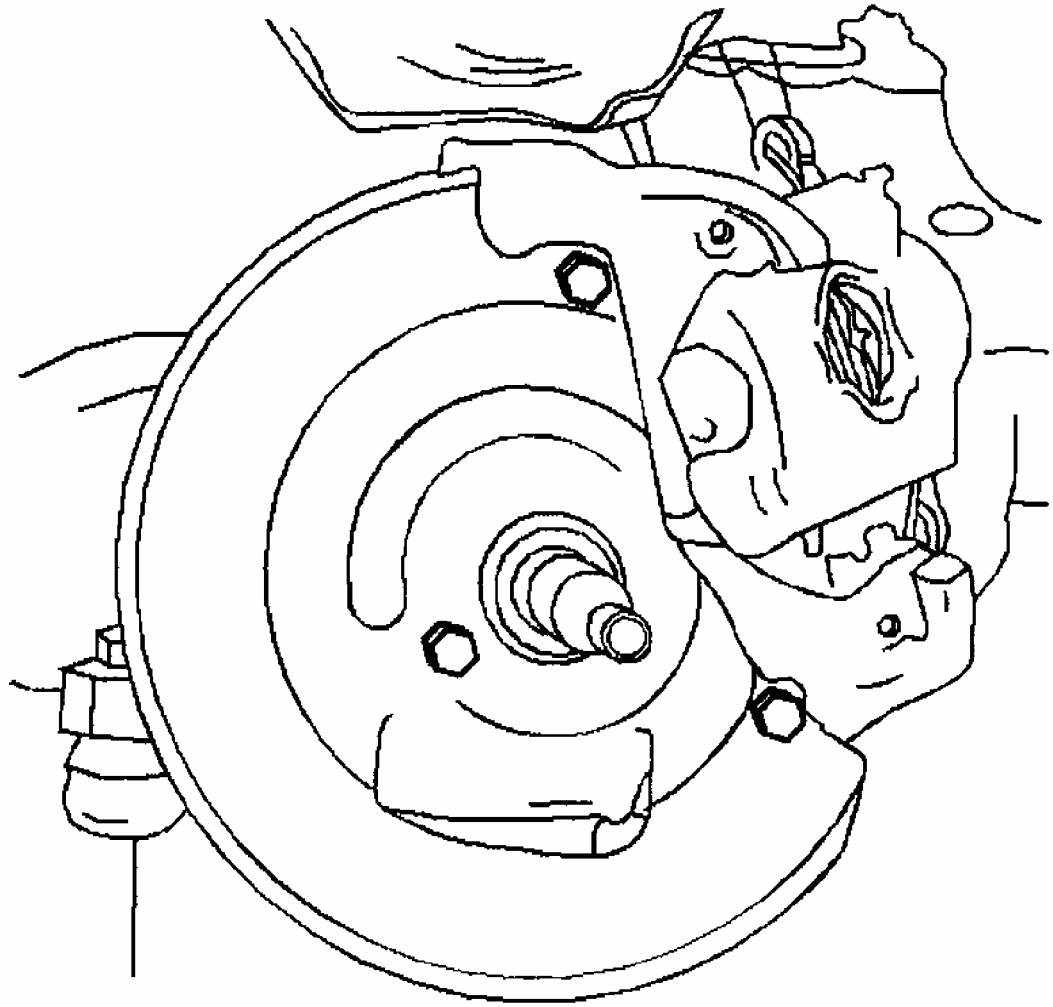

Fig. 42: Removing Bolts That Attach Splash Shield To Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

4. Remove the cotter pin.
5. Remove the tie rod end stud nut.
6. Disconnect the tie rod end from the steering knuckle using *J 24319-B* .

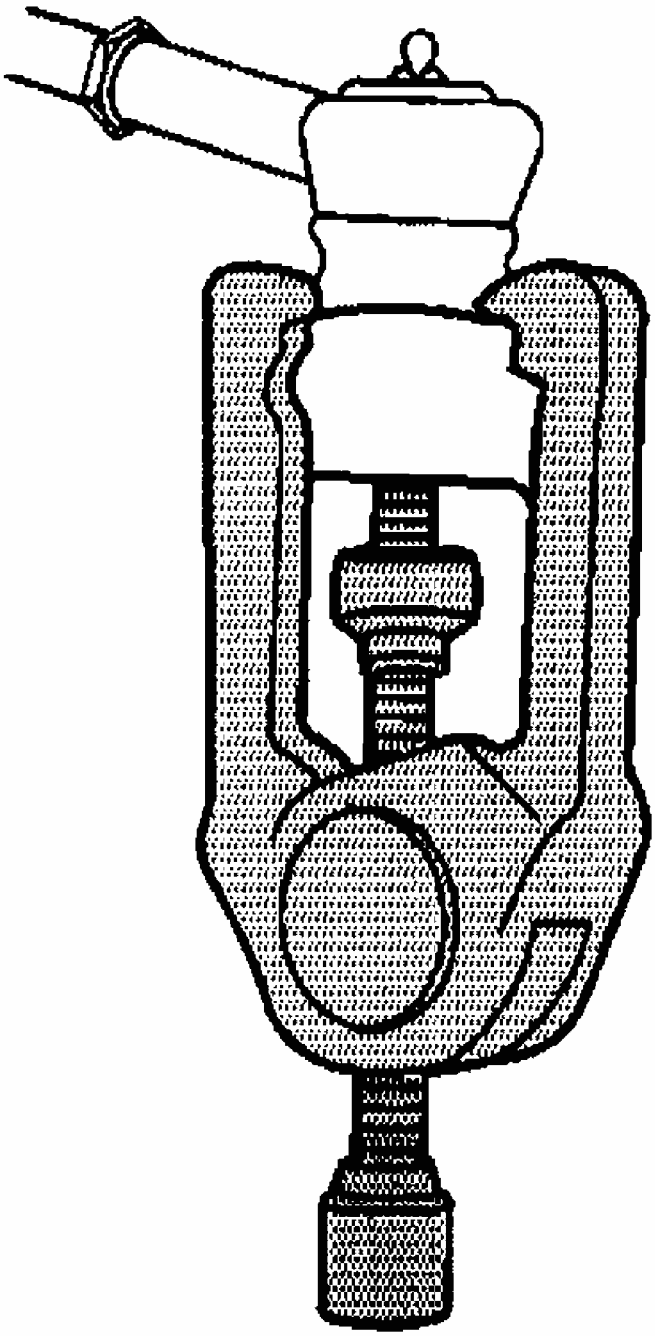

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Fig. 43: Disconnecting Tie Rod End From Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

7. Remove the lower ball joint stud from the steering knuckle using *J 23742* .

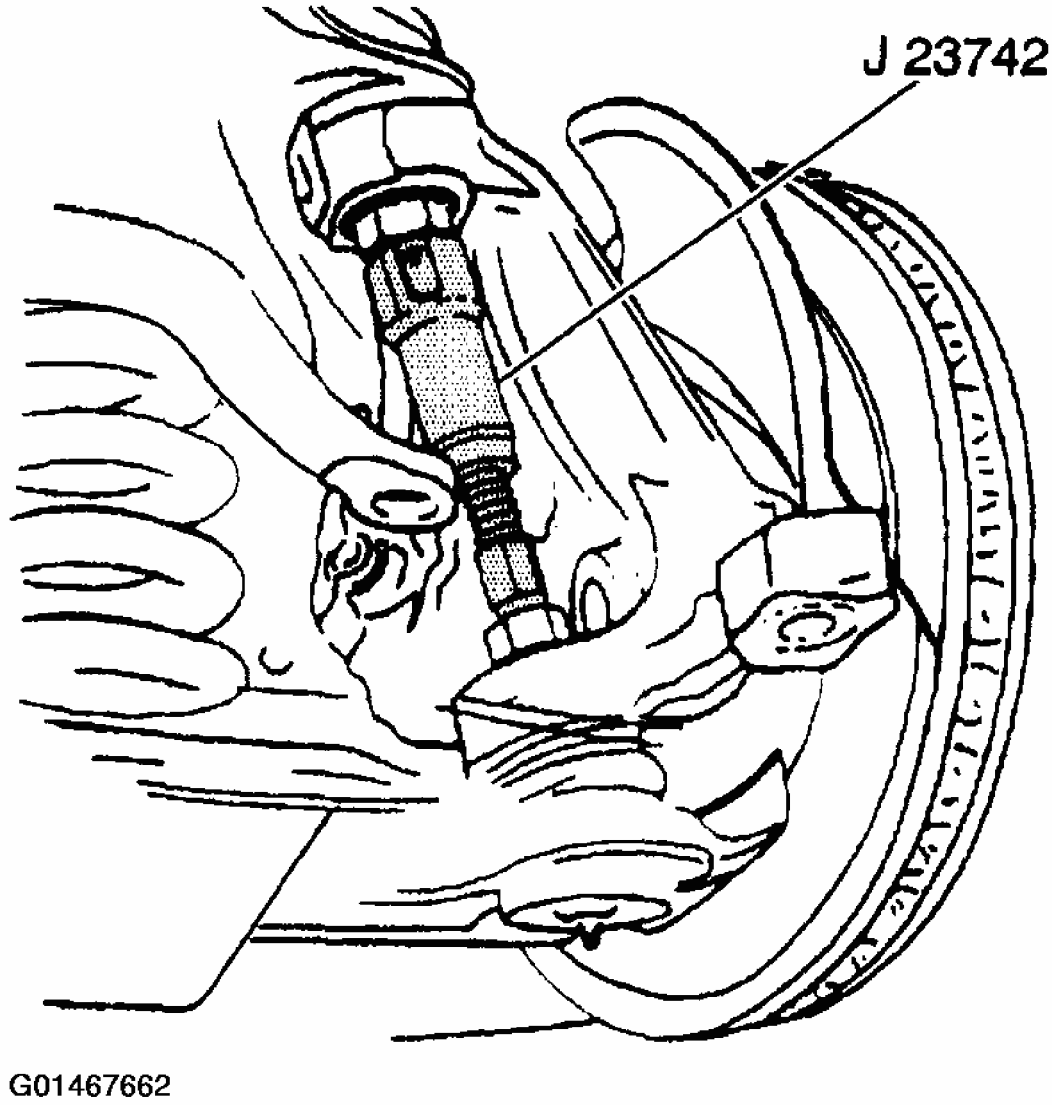

Fig. 44: Removing Lower Ball Joint Stud From Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

8. Remove the upper ball joint stud from the steering knuckle using *J 23742* .
9. Raise the upper control arm. Disengage the ball joint stud from the steering knuckle.
10. Remove the steering knuckle from the lower ball joint stud.
    10.1 Clean the steering knuckle.
    10.2 Inspect the steering knuckle tapered hole. Replace the steering knuckle if this tapered hole is out-of-round, deformed, or damaged.

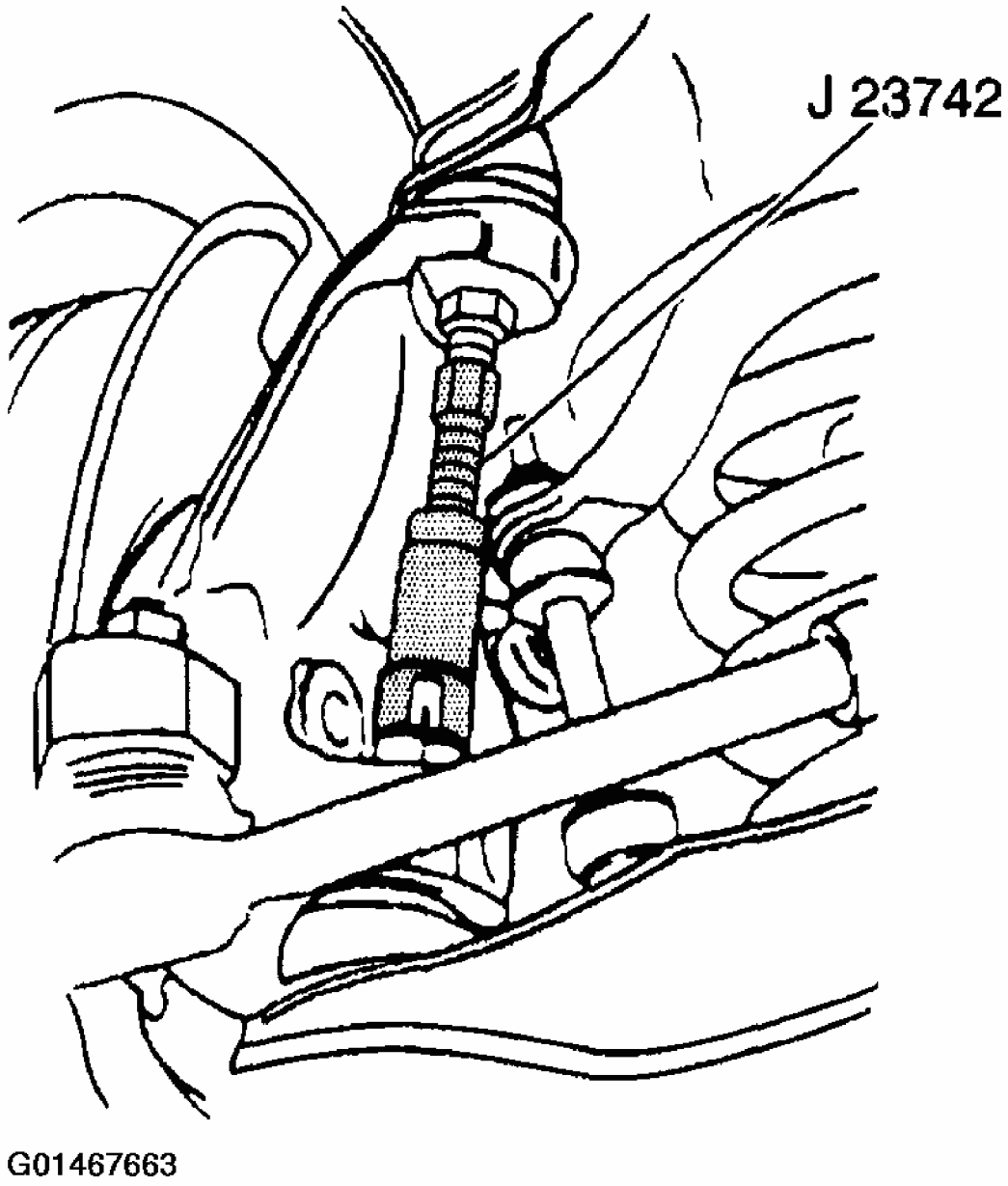

Fig. 45: Removing Upper Ball Joint Stud From Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the upper ball joint to the steering knuckle. Refer to **UPPER BALL JOINT REPLACEMENT (RWD)** or **UPPER BALL JOINT REPLACEMENT (4WD)** .
2. Install the lower ball joint to the steering knuckle. Refer to **LOWER BALL JOINT REPLACEMENT (RWD)** or **LOWER BALL JOINT REPLACEMENT (4WD)** .
3. Install the splash shield to the steering knuckle.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

4. Install the splash shield bolts.

   Tighten

   Tighten the splash shield bolts to 26 N.m (19 lb ft).

5. Install the tie rod end to the steering knuckle. Ensure that the seal is on the stud.

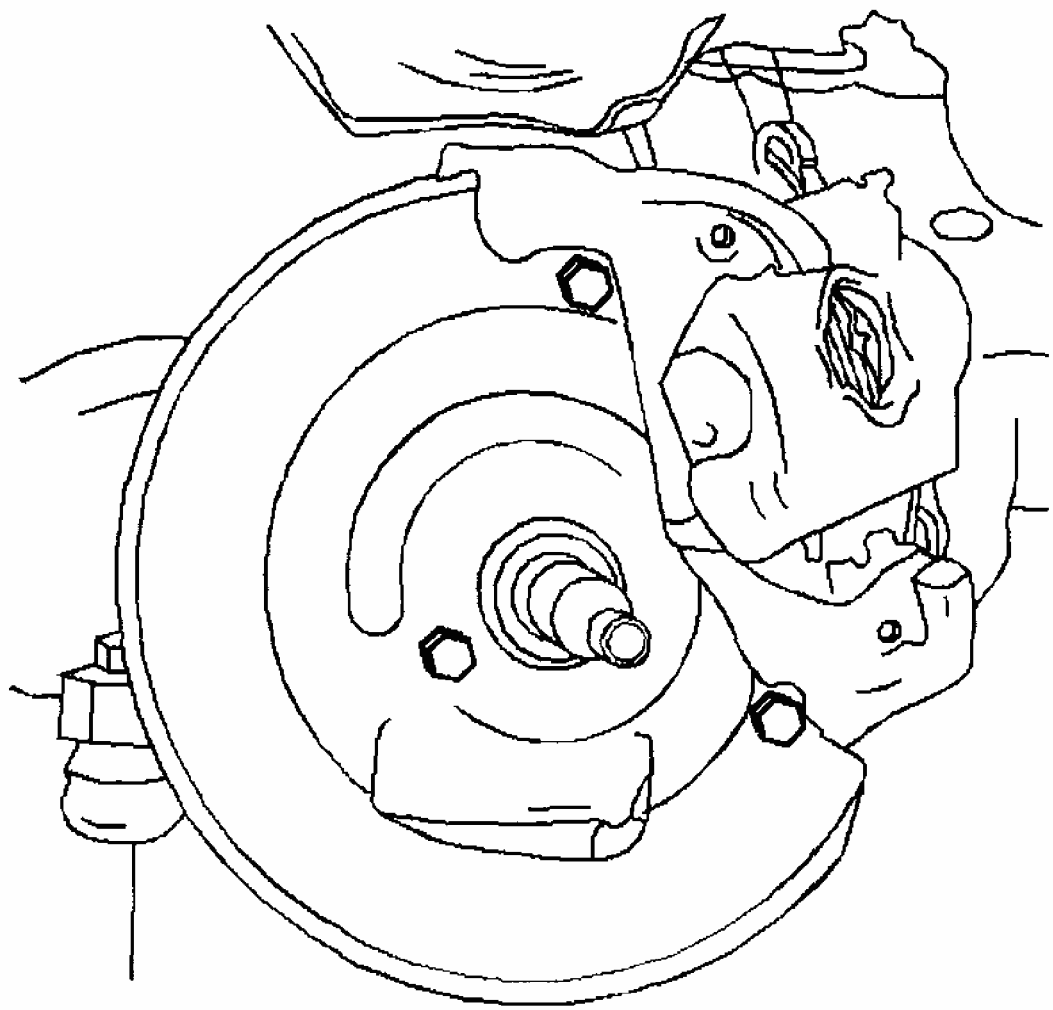

Fig. 46: Splash Shield Bolts
Courtesy of GENERAL MOTORS CORP.

6. Seat the taper using *J 29193* .

Tighten

Tighten *J 29193* to 54 N.m (40 lb ft).

Remove *J 29193* from the tie rod end ball stud.

7. Install the tie rod end retaining nut.

   Tighten

   Tighten the tie rod end retaining nut to 53 N.m (39 lb ft).

8. Install the wheel hub and bearing. Refer to **WHEEL HUB, BEARING, AND SEAL REPLACEMENT (RWD PICKUP)** or **WHEEL HUB, BEARING, AND SEAL REPLACEMENT (4WD PICKUP AND UTILITIES)** .
9. Lower the vehicle.
10. Check the front wheel alignment. Refer to **WHEEL ALIGNMENT SPECIFICATIONS** in Wheel Alignment.

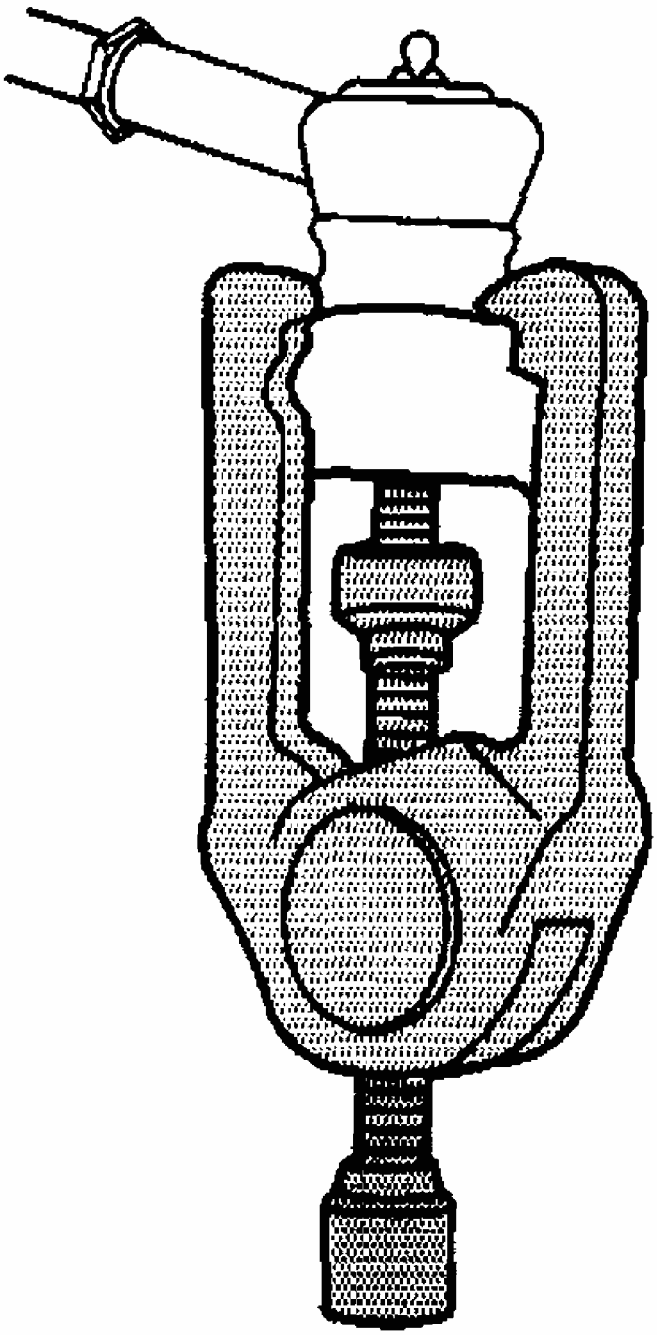

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Fig. 47: Removing Outer Tie Rod End From Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

STEERING KNUCKLE REPLACEMENT (4WD)

Tools Required

- *J 24319-B* Steering Linkage and Tie Rod Puller
- *J 43631* Ball Joint Separator Tool

Removal Procedure

1. Raise and support the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the tire and wheel. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
3. Remove the wheel hub and bearing. Refer to **WHEEL HUB, BEARING, AND SEAL REPLACEMENT (RWD PICKUP)** or **WHEEL HUB, BEARING, AND SEAL REPLACEMENT (4WD PICKUP AND UTILITIES)** .
4. Remove the cotter pin from the outer tie rod retaining nut.
5. Remove the outer tie rod retaining nut.
6. Remove the outer tie rod end from the steering knuckle using *J 24319-B* .
7. Remove the wheel speed sensor wiring harness bracket and brake hose bracket mounting bolts and nuts from the upper control arm.
8. Disconnect the wheel speed sensor wiring harness bracket and brake hose bracket from the upper control arm.

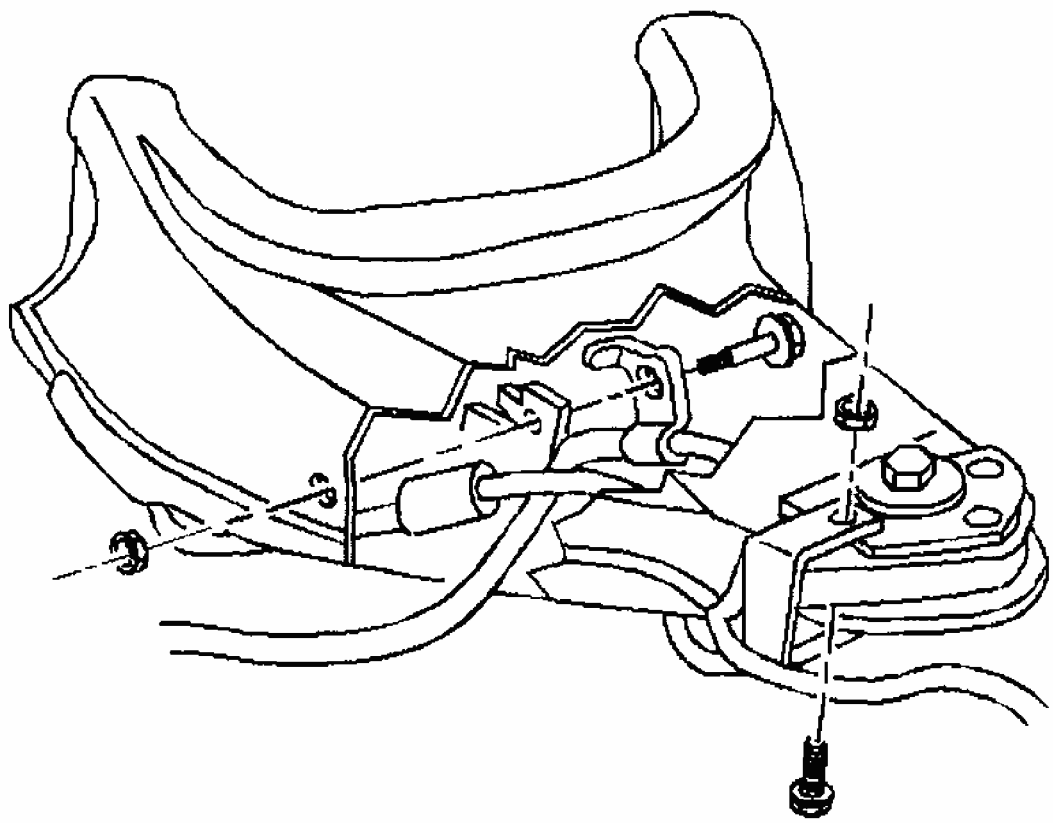

Fig. 48: Wheel Speed Sensor Wiring Harness Bracket & Brake Hose Bracket
Courtesy of GENERAL MOTORS CORP.

9. Remove the cotter pin from the upper ball joint retaining nut.
10. Remove the upper ball joint retaining nut.
11. Using a pry bar, placed under the upper control arm and on top of the frame, pry upward.
12. With the aid of a helper, carefully hammer on the steering knuckle in the area of the upper ball joint stud in order to release the stud from the steering knuckle.
13. Remove the upper ball joint from the steering knuckle.
14. Remove the cotter pin from the lower joint retaining nut.
15. Remove the lower ball joint retaining nut.
16. Disconnect the lower ball joint from the steering knuckle using *J 43631* .

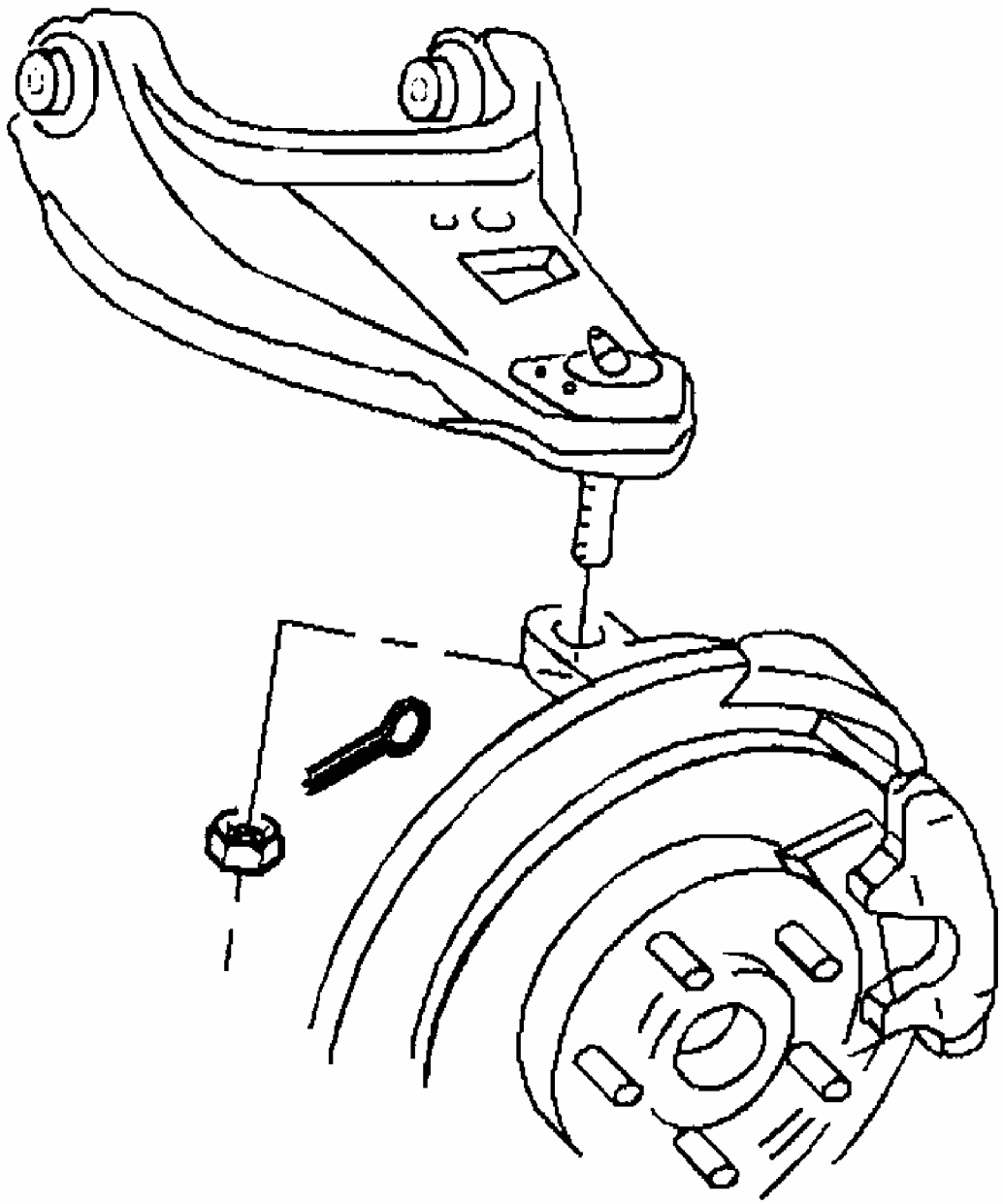

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Fig. 49: Removing Upper Ball Joint From Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

17. Remove the steering knuckle from the vehicle.
18. Remove the steering knuckle seal.

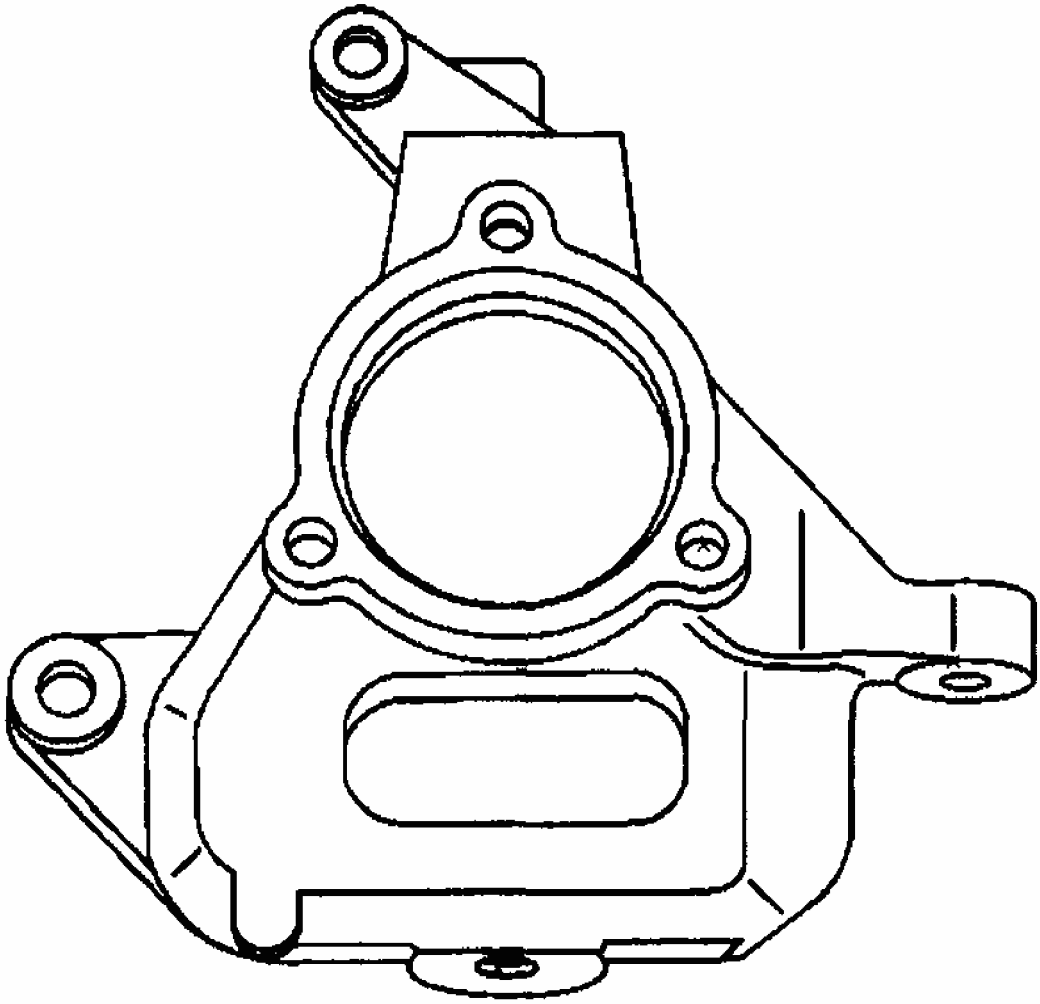

Fig. 50: Steering Knuckle From Vehicle
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the steering knuckle seal.
2. Install the steering knuckle to the upper and lower ball joints ball studs.

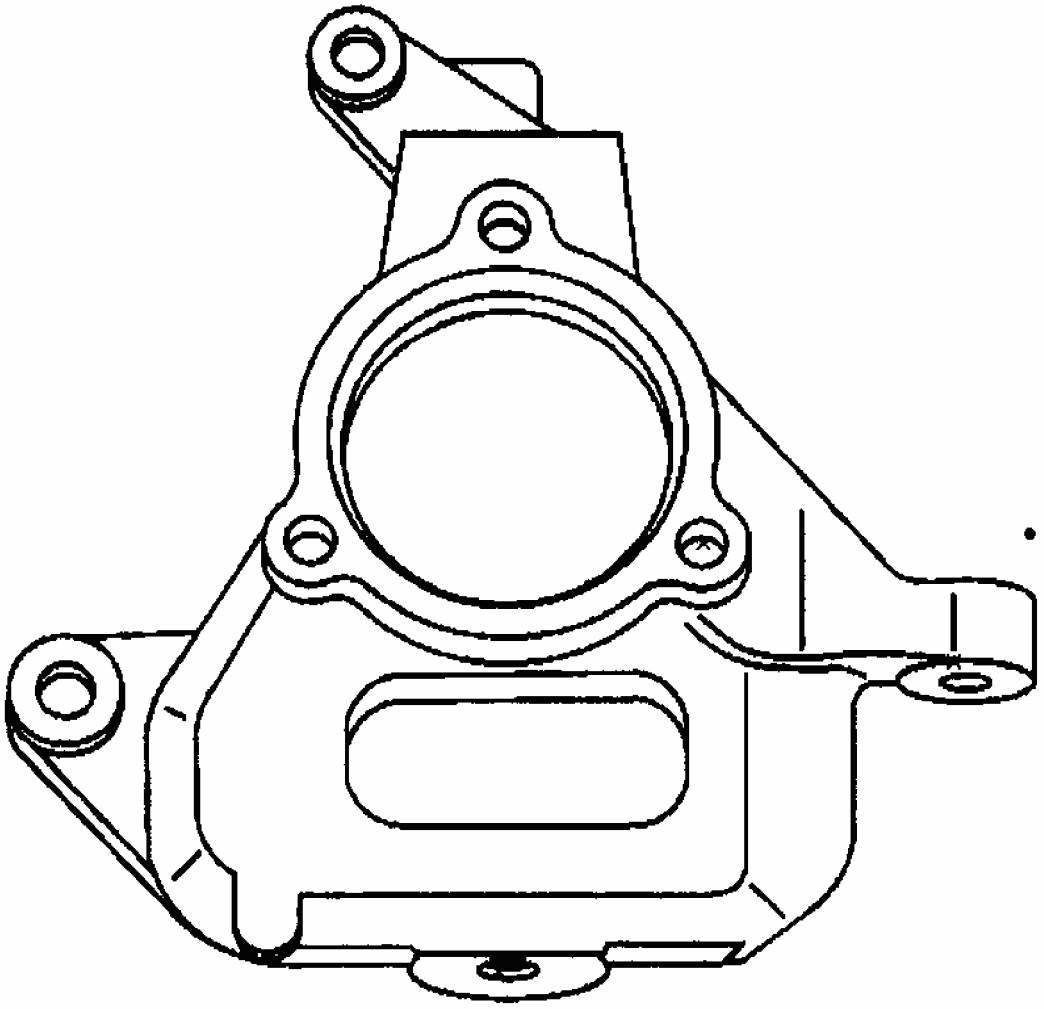

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Fig. 51: Steering Knuckle Seal
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

3. Install the lower ball joint to the steering knuckle retaining nut.

   Tighten

   - Tighten the lower ball joint to steering knuckle retaining nut to 108 N.m (79 lb ft).
   - Tighten the lower ball joint retaining nut in order to align the cotter pin. Do not tighten the lower ball joint retaining nut more than 1/6 turn.

4. Install a new cotter pin to the lower ball joint retaining nut. Bend the pin ends against

the nut.

5. Install the upper ball joint to the steering knuckle retaining nut.

   Tighten

   - Tighten the upper ball joint retaining nut to 83 N.m (61 lb ft).
   - Tighten the upper ball joint retaining nut in order to align the cotter pin. Do not tighten the upper ball joint retaining nut more than 1/6 turn.

6. Install a new cotter pin to the upper ball joint stud. Bend the pin ends against the nut.

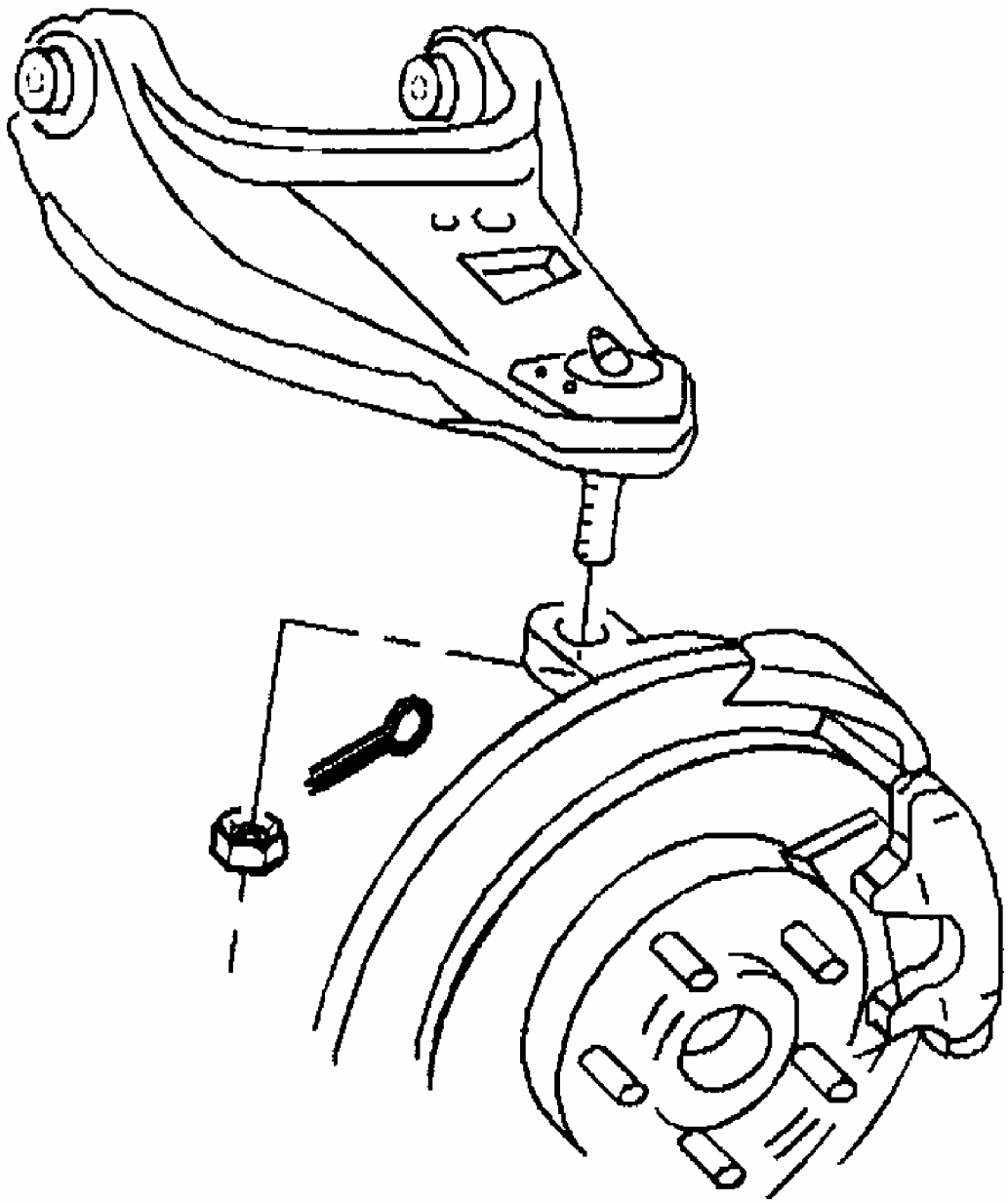

Fig. 52: Installing Upper Ball Joint To Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

7. Install the tie rod end ball stud to the steering knuckle.
8. Install the outer tie rod ball retaining nut.

Tighten

Tighten the outer tie rod ball retaining nut to 53 N.m (39 lb ft).

9. Install a new cotter pin to the outer tie rod retaining nut. Bend the pin ends against the nut flats.
10. Install the wheel hub and bearing. Refer to **WHEEL HUB, BEARING, AND SEAL REPLACEMENT (RWD PICKUP)** or **WHEEL HUB, BEARING, AND SEAL REPLACEMENT (4WD PICKUP AND UTILITIES)** .
11. Check the front wheel alignment. Refer to **MEASURING WHEEL ALIGNMENT** in Wheel Alignment.

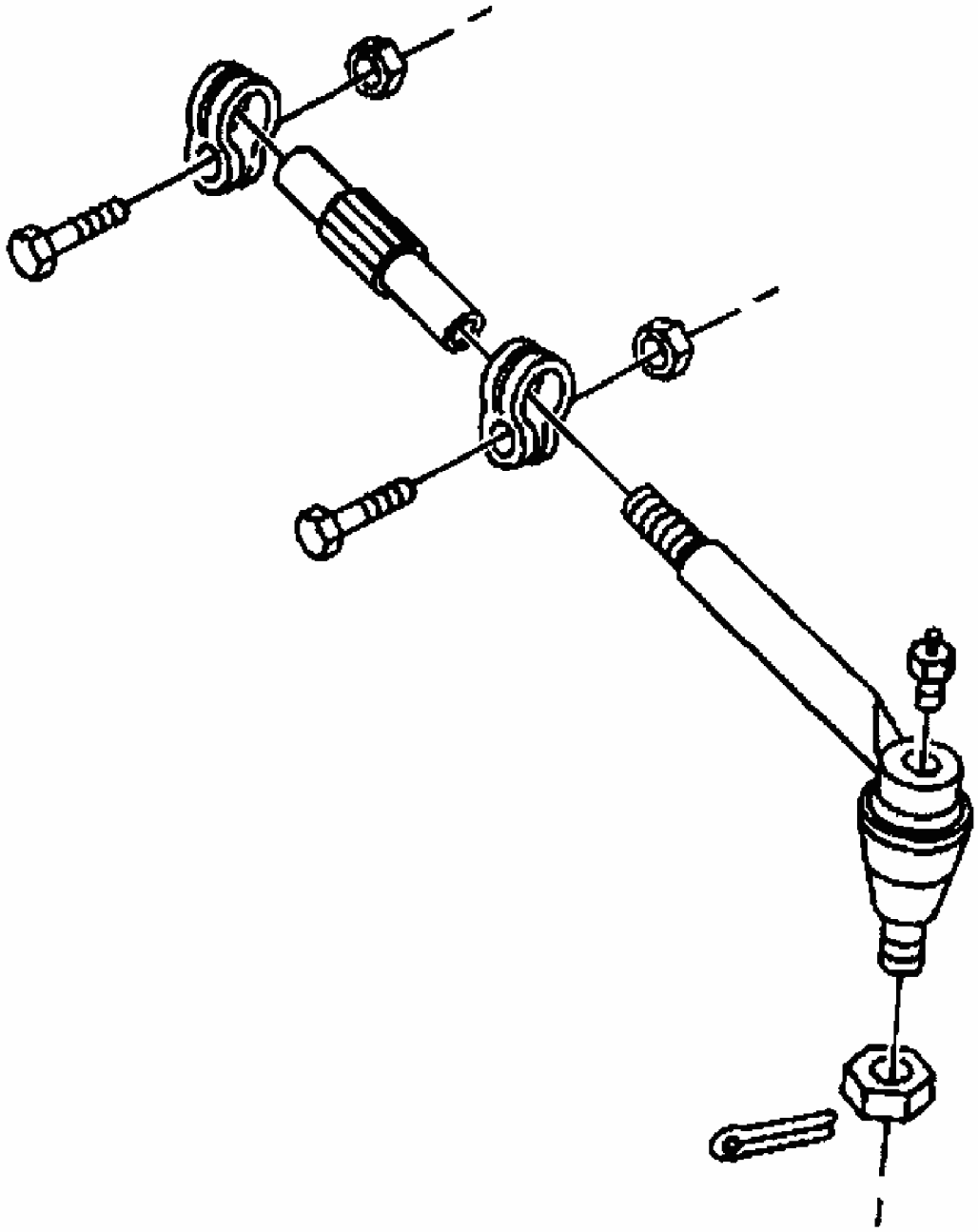

Fig. 53: Tie Rod End Ball Stud
Courtesy of GENERAL MOTORS CORP.

UPPER CONTROL ARM REPLACEMENT (RWD)

Removal Procedure

CAUTION: Refer to FLOOR JACK CAUTION in Cautions and Notices.

1. Raise the front of the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
   - Support the lower control arm with floor stands.
   - Place floor stands under the lower control arms as far outboard as possible (between spring seats and ball joint) to maintain maximum leverage.
2. Remove the tire and wheel assembly. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.

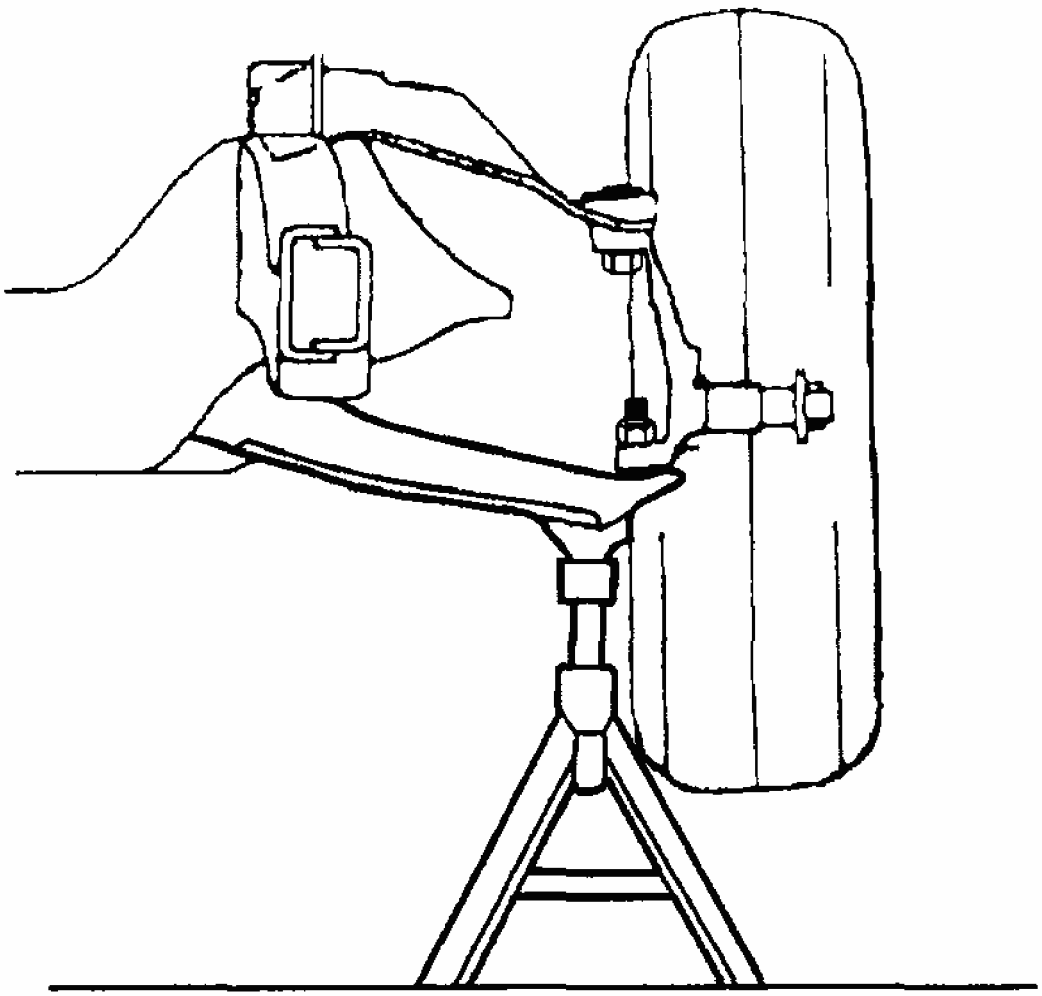

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Fig. 54: Supporting Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

3. Remove the wheel speed sensor harness and the brake hose bracket from the upper control arm.
4. Remove the upper ball joint stud from the steering knuckle. Refer to **UPPER BALL JOINT REPLACEMENT (RWD)** or **UPPER BALL JOINT REPLACEMENT (4WD)** .

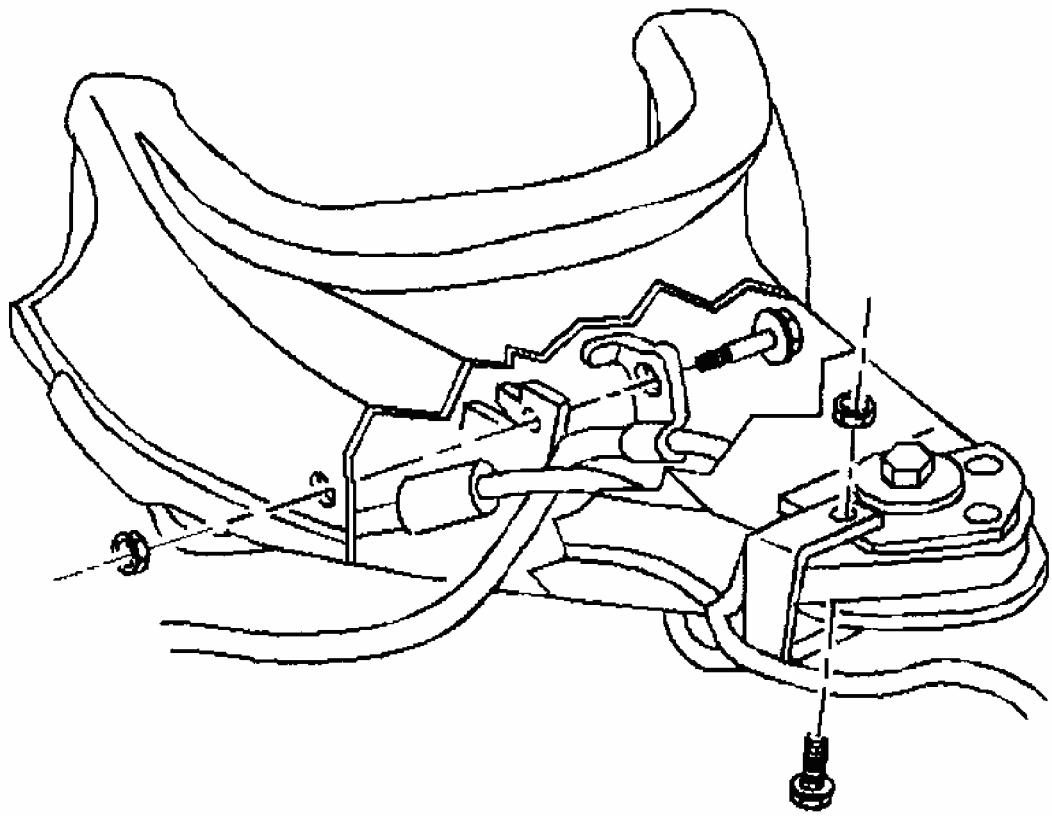

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Fig. 55: Wheel Speed Sensor Harness & Brake Hose Bracket
Courtesy of GENERAL MOTORS CORP.

5. Remove the retaining bolts and nuts from the upper control arm. Note the location of any shims.

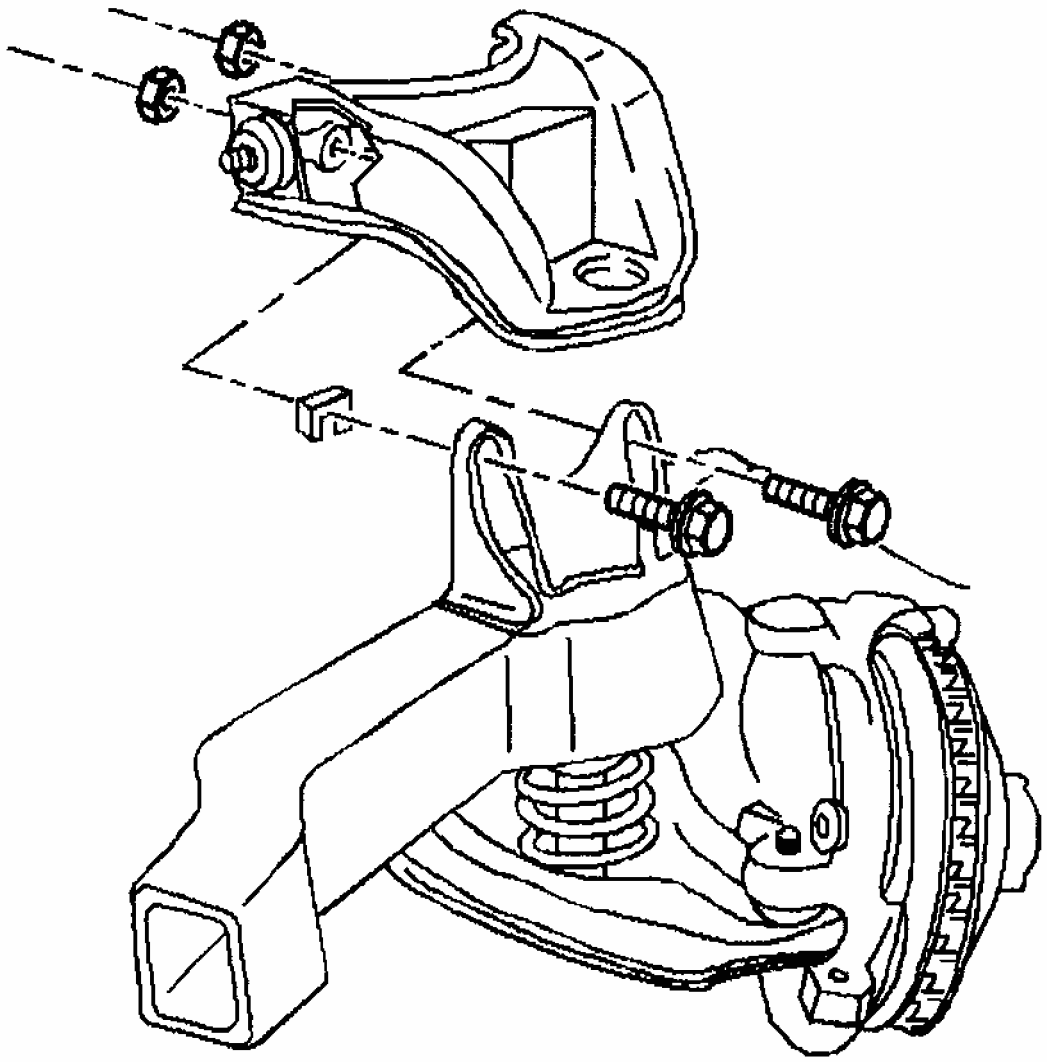

Fig. 56: Removing Retaining Bolts & Nuts From Upper Control Arm
Courtesy of GENERAL MOTORS CORP.

6. Remove the upper control arm.
7. Inspect all of the parts for wear and damage.

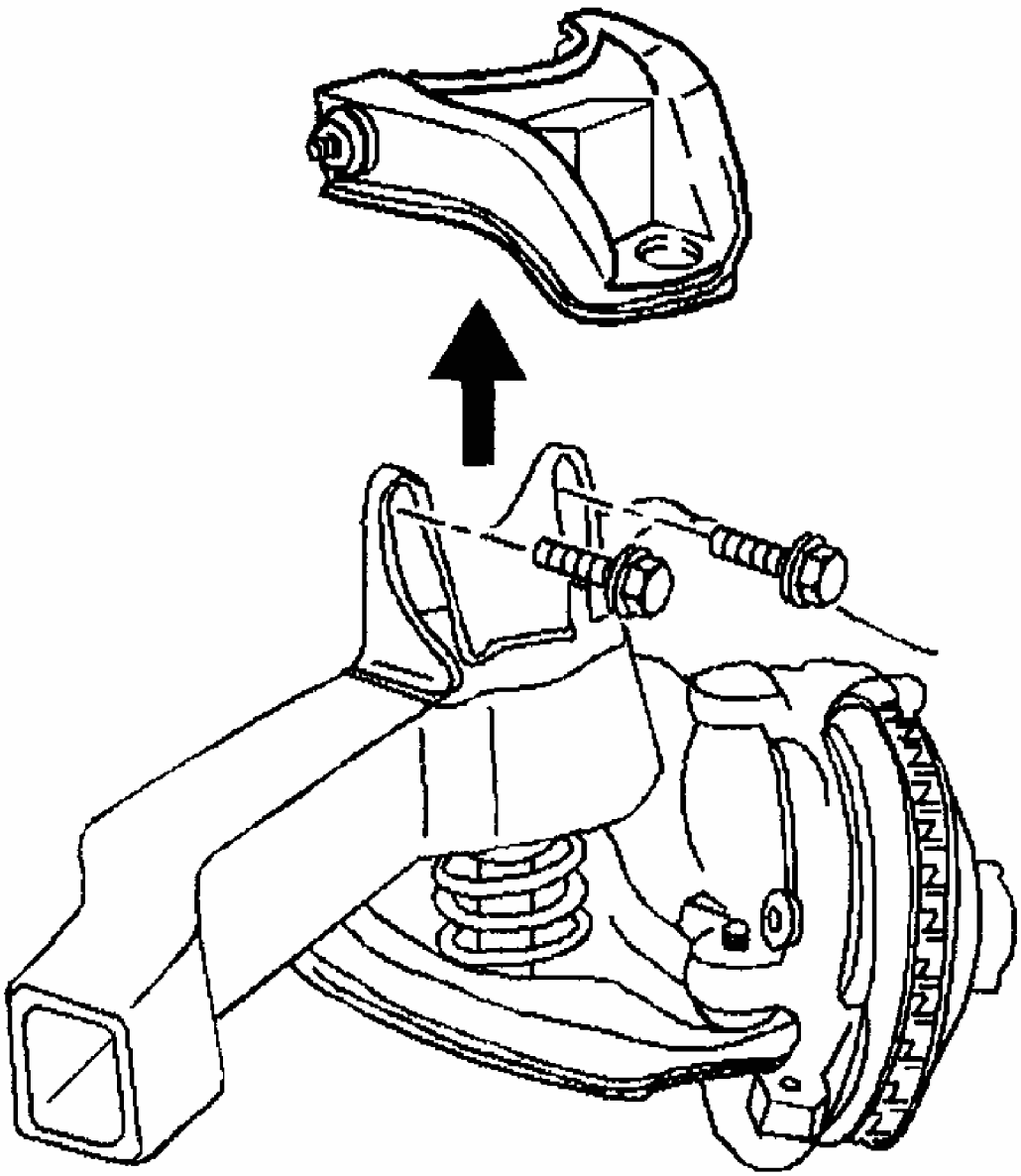

Fig. 57: Upper Control Arm
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the upper control arm to the frame.

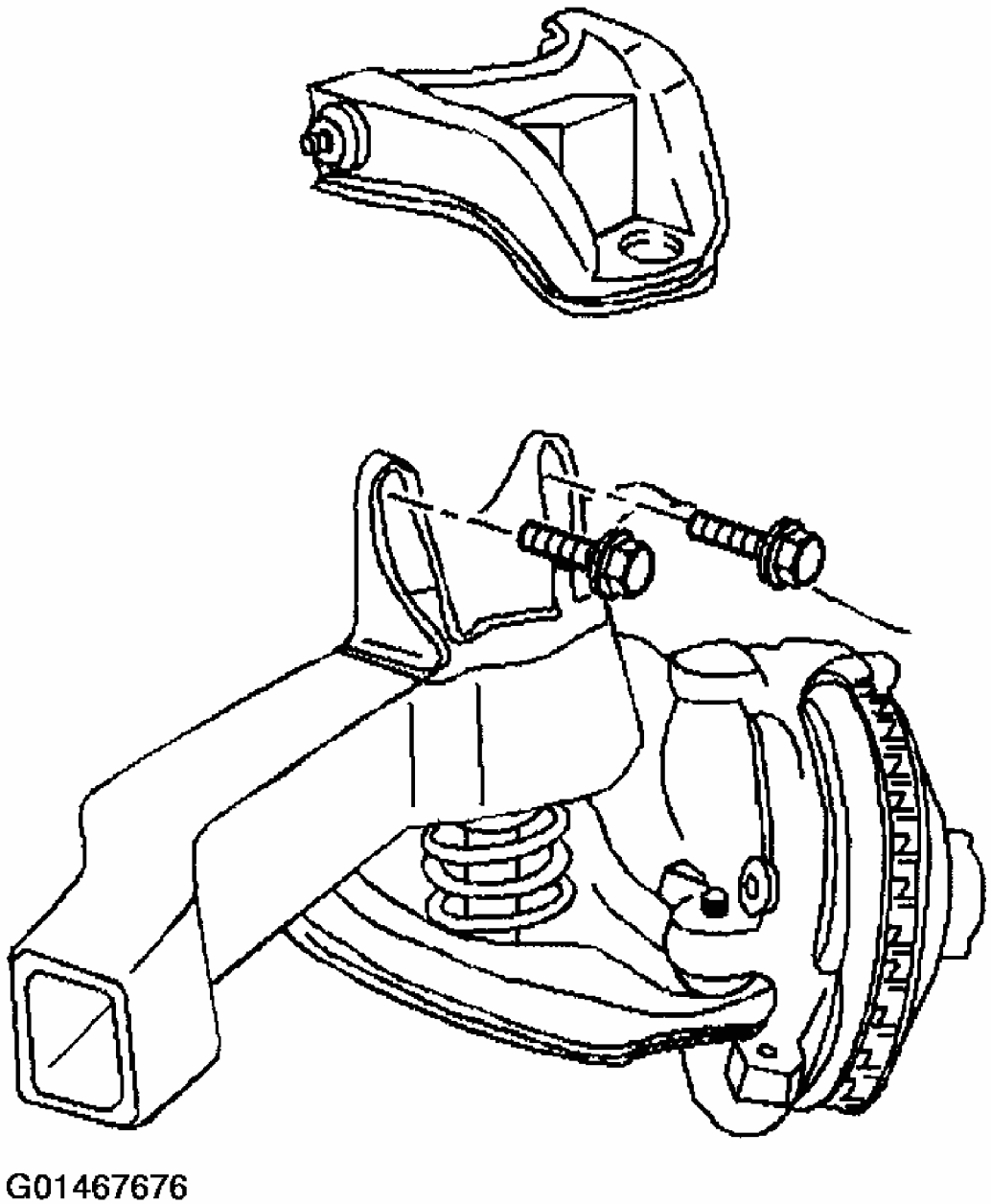

Fig. 58: Installing Upper Control Arm To Frame
Courtesy of GENERAL MOTORS CORP.

2. Install the upper control arm retaining bolts.
3. Install the shims to the original position.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

4. Install the upper control arm retaining nuts.

   Tighten

   - Tighten the upper control arm retaining nuts with the front suspension loaded.
   - Tighten the upper control arm retaining nuts to 75 N.m (55 lb ft).
5. Install the upper ball joint stud to the steering knuckle. Refer to **UPPER BALL JOINT REPLACEMENT (RWD)** or **UPPER BALL JOINT REPLACEMENT (4WD)** .
6. Tighten the upper control arm shaft nuts.

   Tighten

   Tighten the upper control arm shaft nuts to 115 N.m (85 lb ft).

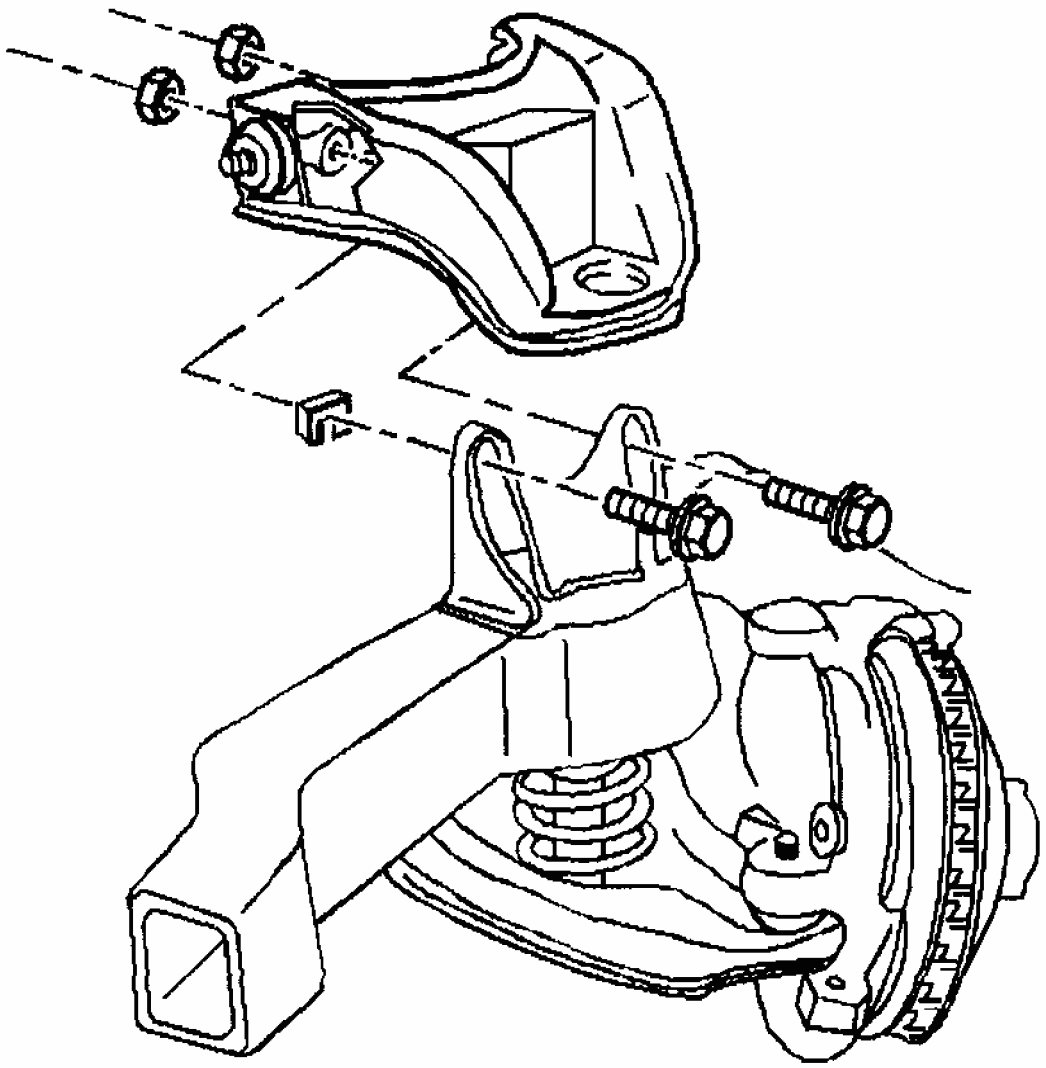

Fig. 59: Upper Control Arm Shaft Nuts & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Install the ABS wire and the brake hose bracket to the upper control arm.
8. Install the ABS wire and the brake hose bracket to the upper control arm mounting bolts and nuts.

Tighten

Tighten the ABS wire and the brake hose bracket to the upper control arm nuts to 24 N.m (18 lb ft).

9. Install the tire and wheel assembly. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
10. Lower the vehicle.
11. Check the front wheel alignment. Refer to **MEASURING WHEEL ALIGNMENT** in Wheel Alignment.

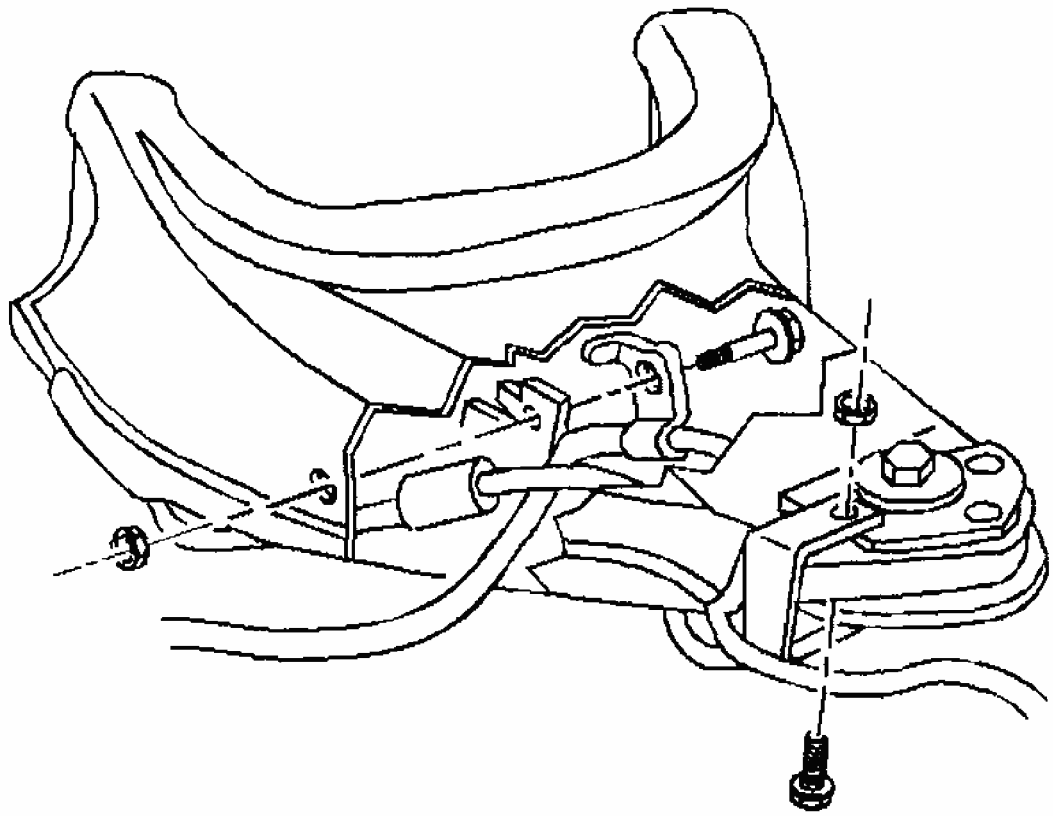

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Fig. 60: Installing ABS Wire & Brake Hose Bracket To Upper Control Arm
Courtesy of GENERAL MOTORS CORP.

UPPER CONTROL ARM REPLACEMENT (4WD)

Removal Procedure

1. Raise the front of the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
   - Support the lower control arm with floor stands.
   - Place floor stands under the lower control arms as far outboard as possible (between spring seats and ball joint) to maintain maximum leverage.

2. Remove the tire and wheel assembly. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.

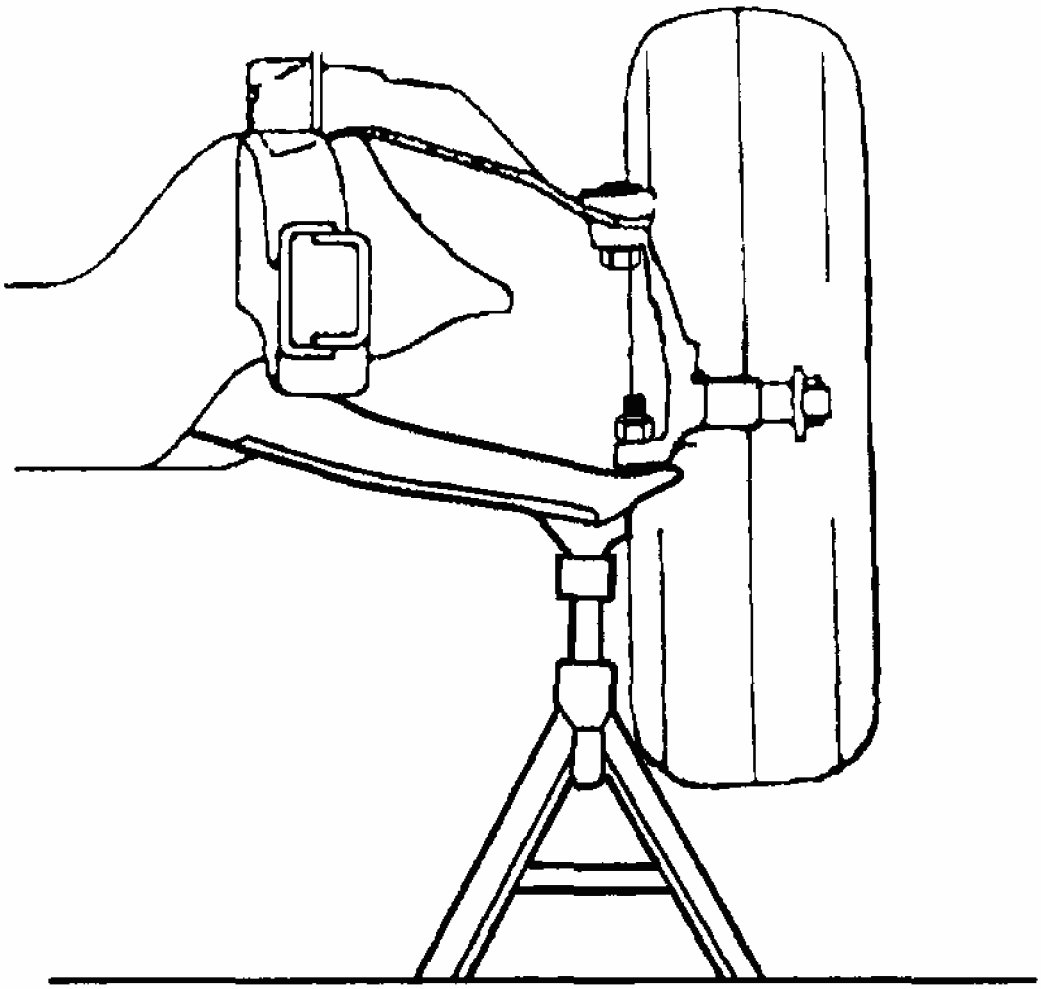

Fig. 61: Supporting Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

3. Unload the torsion bar. Refer to **TORSION BAR AND SUPPORT ASSEMBLY REPLACEMENT** .
4. Remove the shock absorber. Refer to **SHOCK ABSORBER REPLACEMENT (RWD)** or **SHOCK ABSORBER REPLACEMENT (4WD)** .
5. Remove the cotter pin from the upper ball joint stud.
6. Remove the upper ball joint retaining nut.
7. Using a pry bar, placed under the upper control arm and on top of the frame, pry

upward.

8. With the aid of a helper, carefully hammer on the steering knuckle in the area of the upper ball joint stud in order to release the stud from the steering knuckle.
9. Remove the upper ball joint from the steering knuckle.

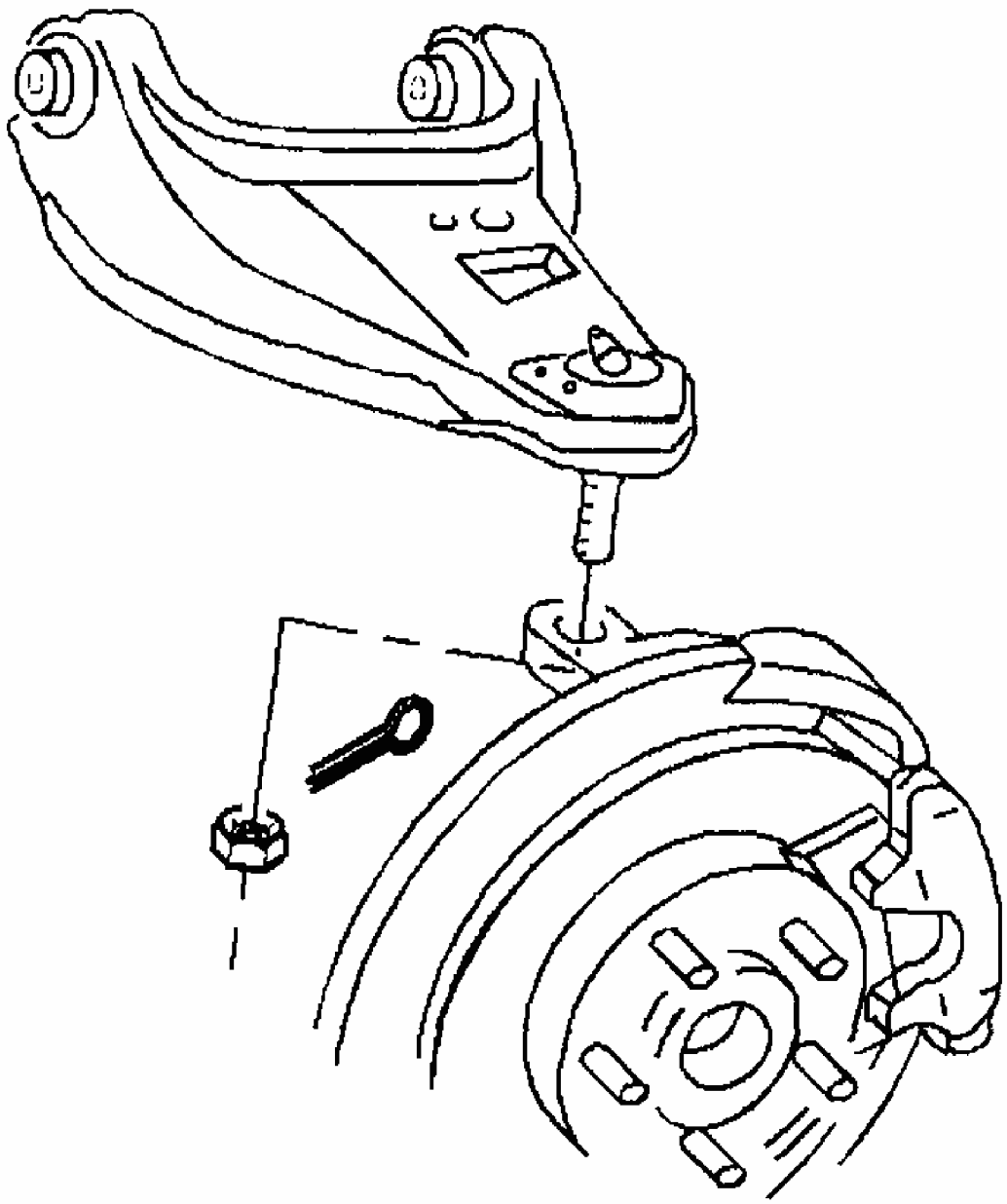

Fig. 62: Removing Upper Ball Joint From Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

10. Remove the upper control arm retaining nuts.
11. Remove the upper control arm outer cams.
12. Remove the upper control arm bolts.
13. Remove the upper control arm inner cams.
14. Remove the upper control arm from the frame.

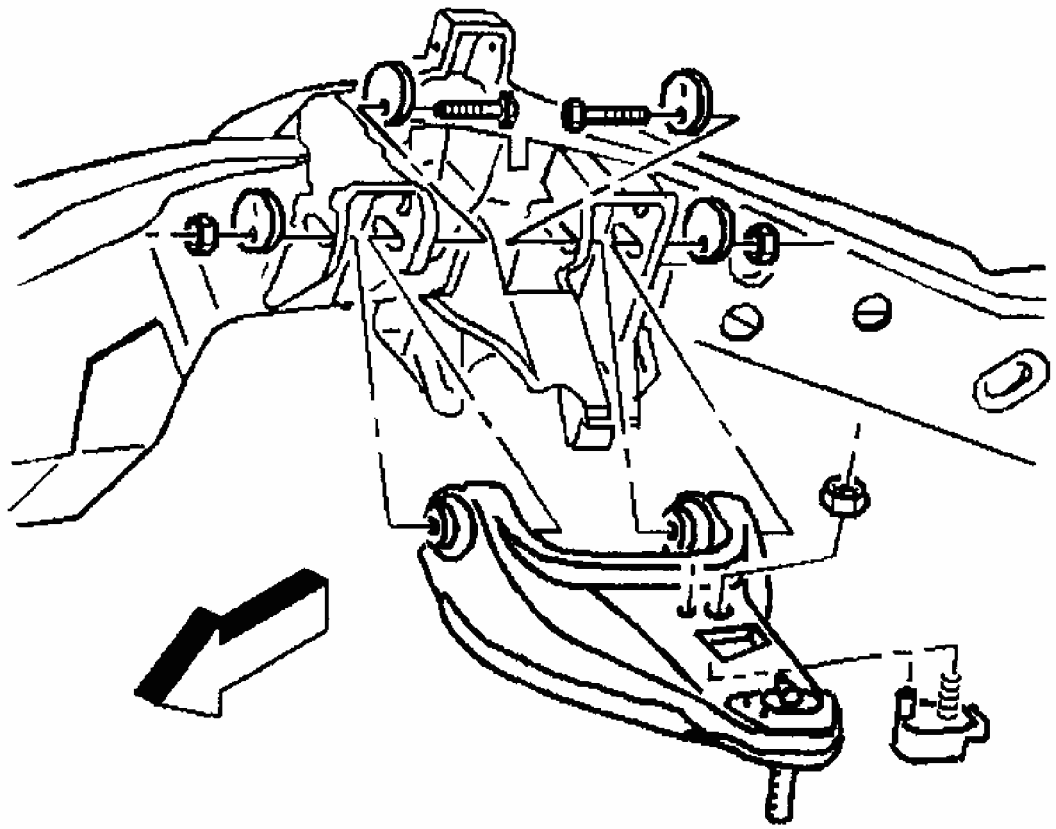

Fig. 63: Removing Upper Control Arm From Frame
Courtesy of GENERAL MOTORS CORP.

15. Remove the upper control arm bumper nut.
16. Remove the upper control arm bumper from the upper control arm.

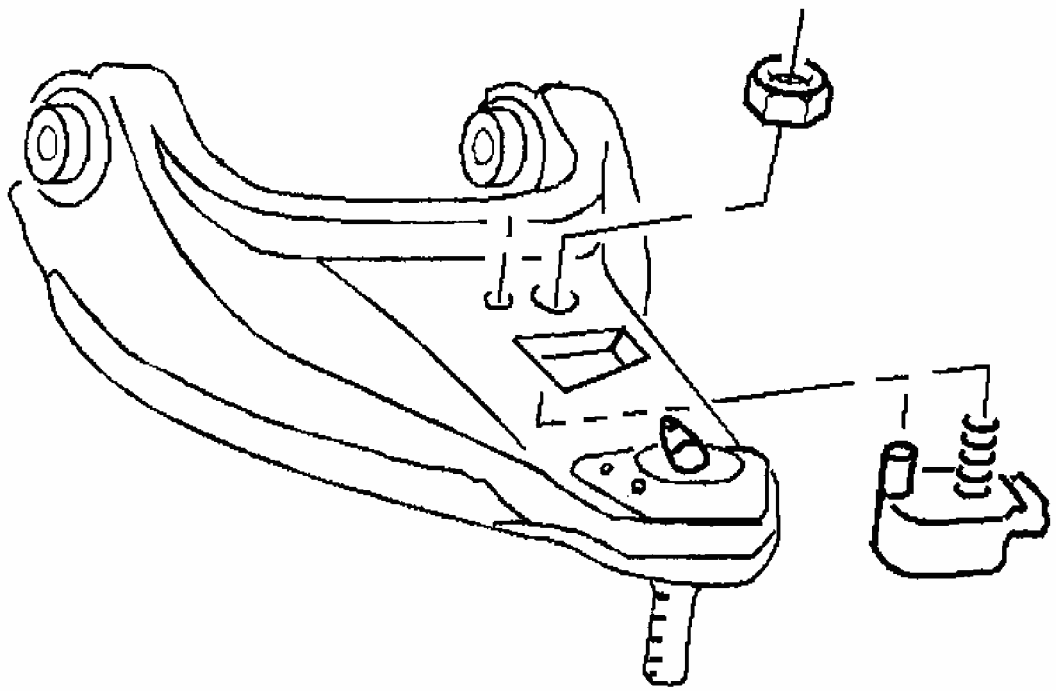

Fig. 64: Upper Control Arm Bumper
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the upper control arm bumper to the upper control arm.

   NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Install the upper control arm bumper retaining nut.

   Tighten

   Tighten the upper control arm bumper retaining nut to 27 N.m (20 lb ft).

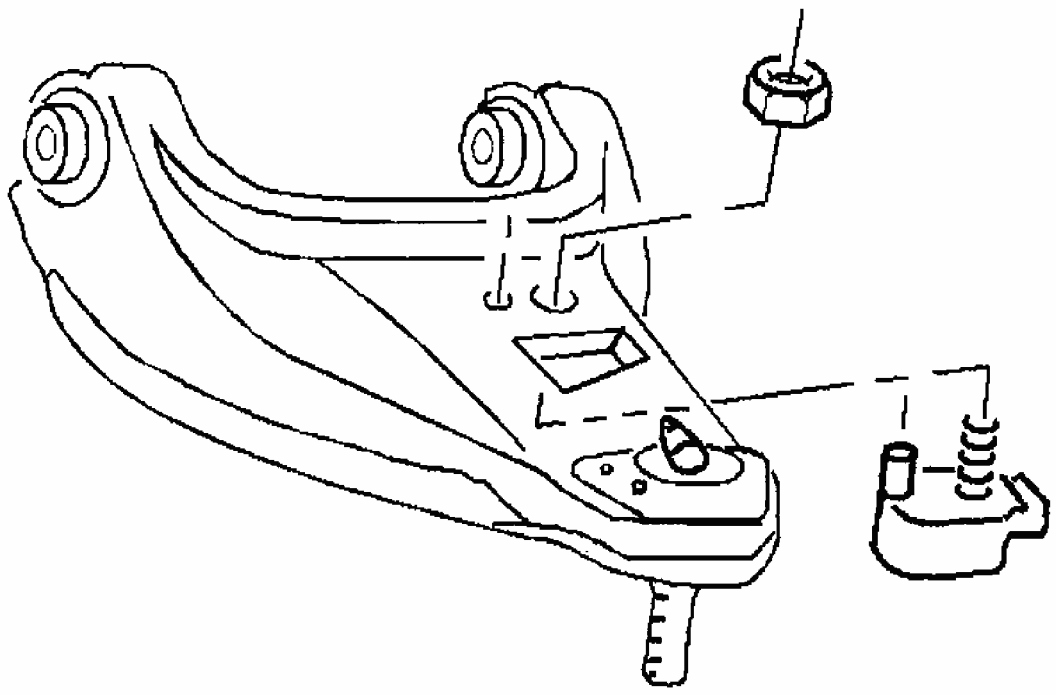

Fig. 65: Upper Control Arm Bumper
Courtesy of GENERAL MOTORS CORP.

3. Install the upper control arm to the frame.
4. Install the upper control arm inner cams to the upper control arm retaining bolts.

   Important: The bolt heads must be opposed inside the bracket.

5. Install the upper control arm retaining bolts to the upper control arm.
6. Install the upper control arm outer cams.

   Important: Tighten the nuts with the front suspension loaded.

7. Install the upper control arm retaining nuts.

   Tighten

   Tighten the upper control arm retaining nuts to 115 N.m (85 lb ft).

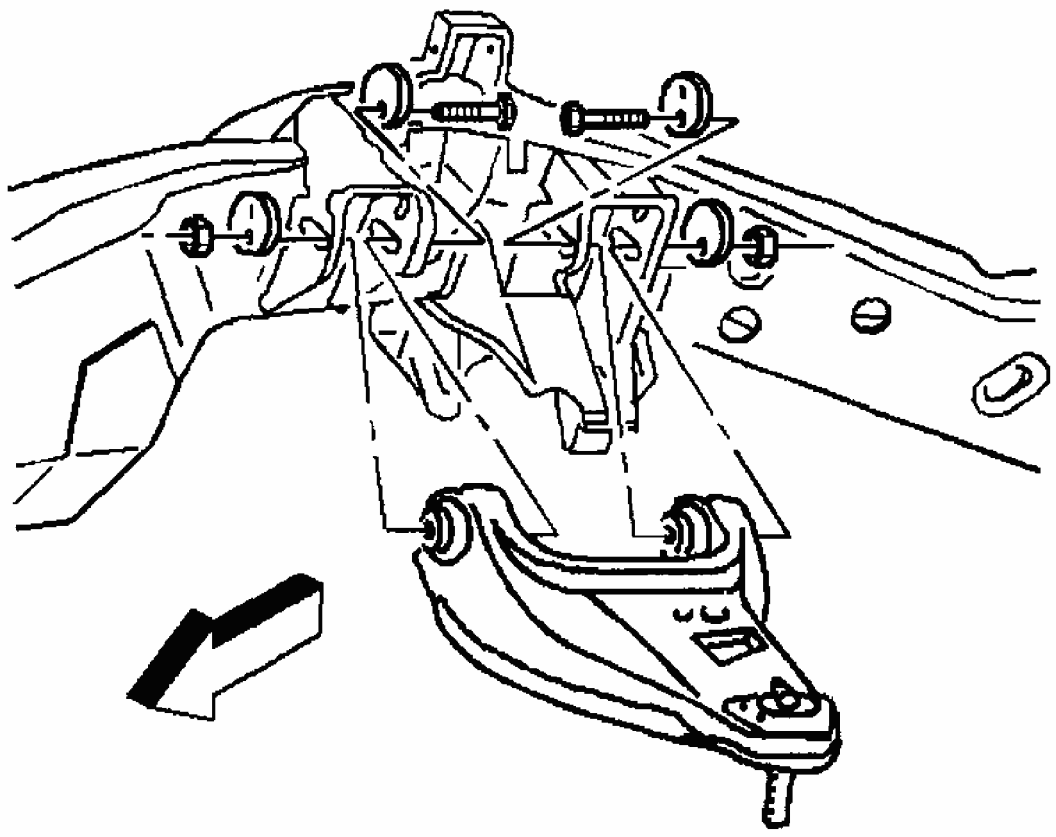

Fig. 66: Installing Upper Control Arm To Frame
Courtesy of GENERAL MOTORS CORP.

8. Install the upper ball joint to the steering knuckle.
9. Install the upper ball joint to the steering knuckle retaining nut.

Tighten

9.1 Tighten the upper ball joint retaining nut to 83 N.m (61 lb ft).

9.2 Tighten the upper ball joint retaining nut in order to align the cotter pin. Do not tighten the upper ball joint nut more than 1/6 turn.

10. Install a new cotter pin to the upper ball joint retaining nut. Bend the pin ends against the nut.
11. Install the shock absorber. Refer to **SHOCK ABSORBER REPLACEMENT (RWD)** or **SHOCK ABSORBER REPLACEMENT (4WD)** .
12. Load the torsion bar. Refer to **TORSION BAR AND SUPPORT ASSEMBLY REPLACEMENT** .

13. Install the tire and wheel assembly. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
14. Lower the vehicle.
15. Check the front wheel alignment. Refer to **MEASURING WHEEL ALIGNMENT** in Wheel Alignment.

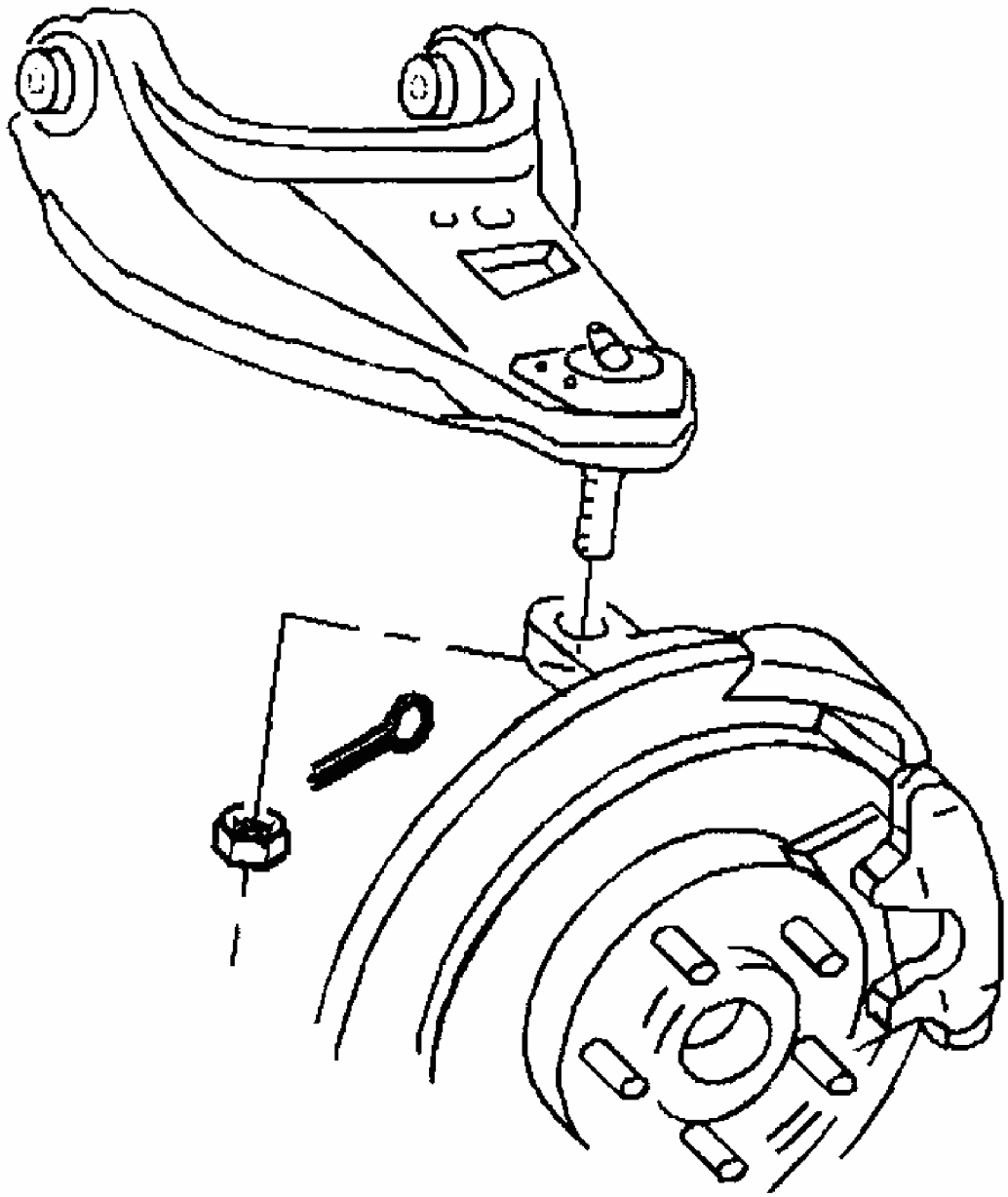

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Fig. 67: Installing Upper Ball Joint To Steering Knuckle

Courtesy of GENERAL MOTORS CORP.

UPPER CONTROL ARM BUSHINGS REPLACEMENT (RWD)

Tools Required

- *J 21474-01* Control Arm Bushing Service Set
- *J 22269-01* Accumulator and Servo Piston Remover

Removal Procedure

1. Remove the upper control arm from the vehicle. Refer to **UPPER CONTROL ARM REPLACEMENT (RWD)** or **UPPER CONTROL ARM REPLACEMENT (4WD)** .
2. Install the upper control arm in a vise.
3. Remove the washers and the nuts from upper control arm shaft.

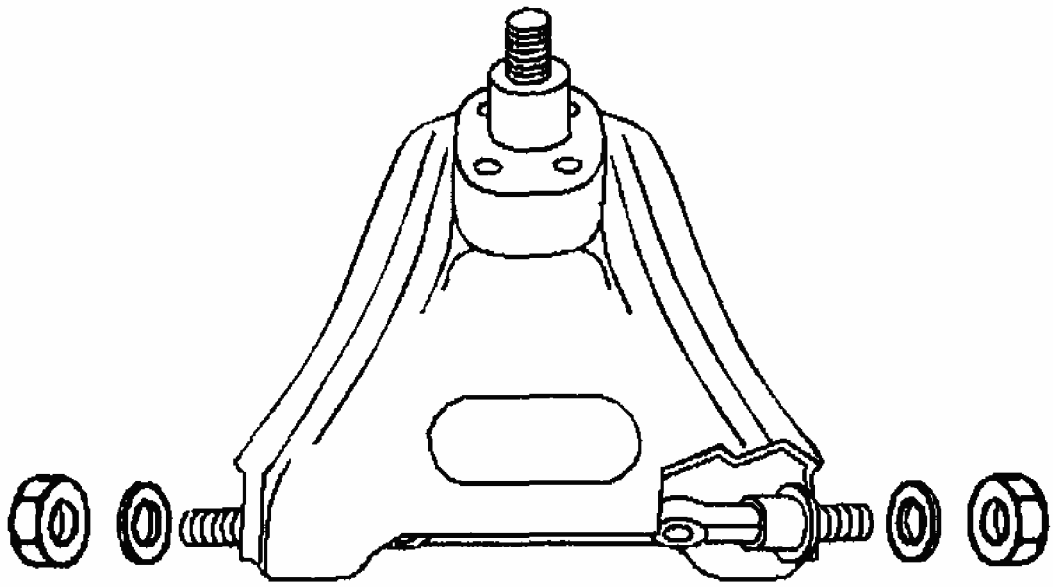

Fig. 68: Removing Washers & Nuts From Upper Control Arm Shaft
Courtesy of GENERAL MOTORS CORP.

4. Remove the upper control arm bushings. Use the *J 22269-01* and *J 21474-5* .

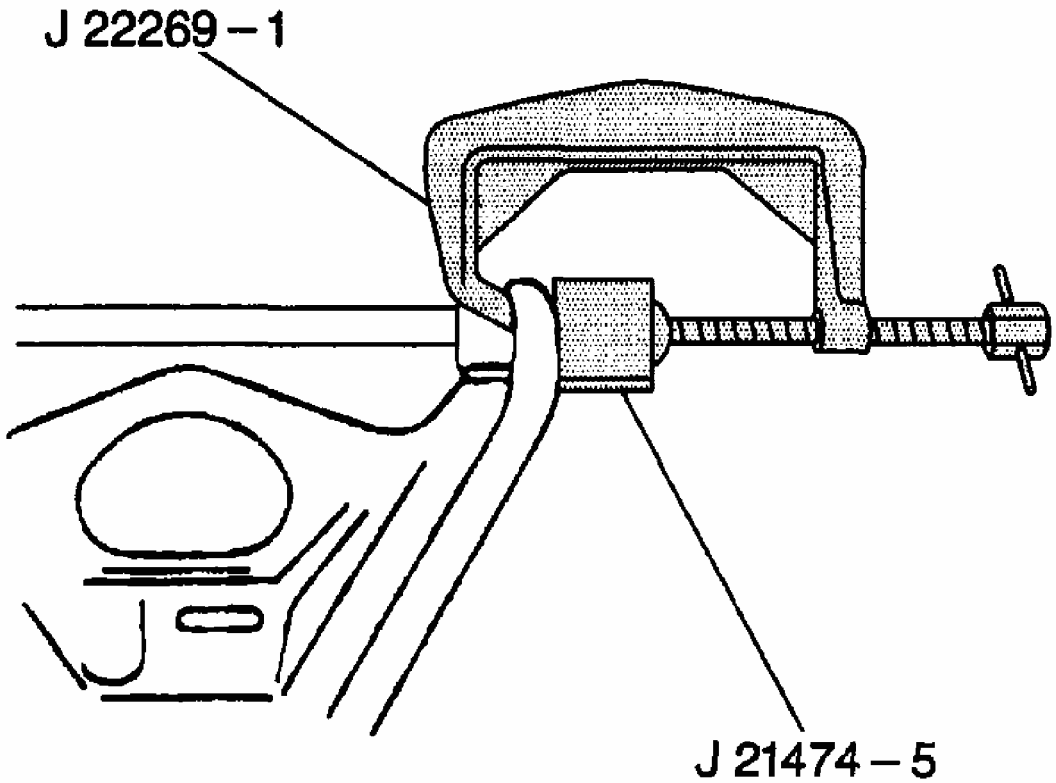

Fig. 69: Upper Control Arm Bushings
Courtesy of GENERAL MOTORS CORP.

5. Remove the upper control arm shaft from the upper control arm.

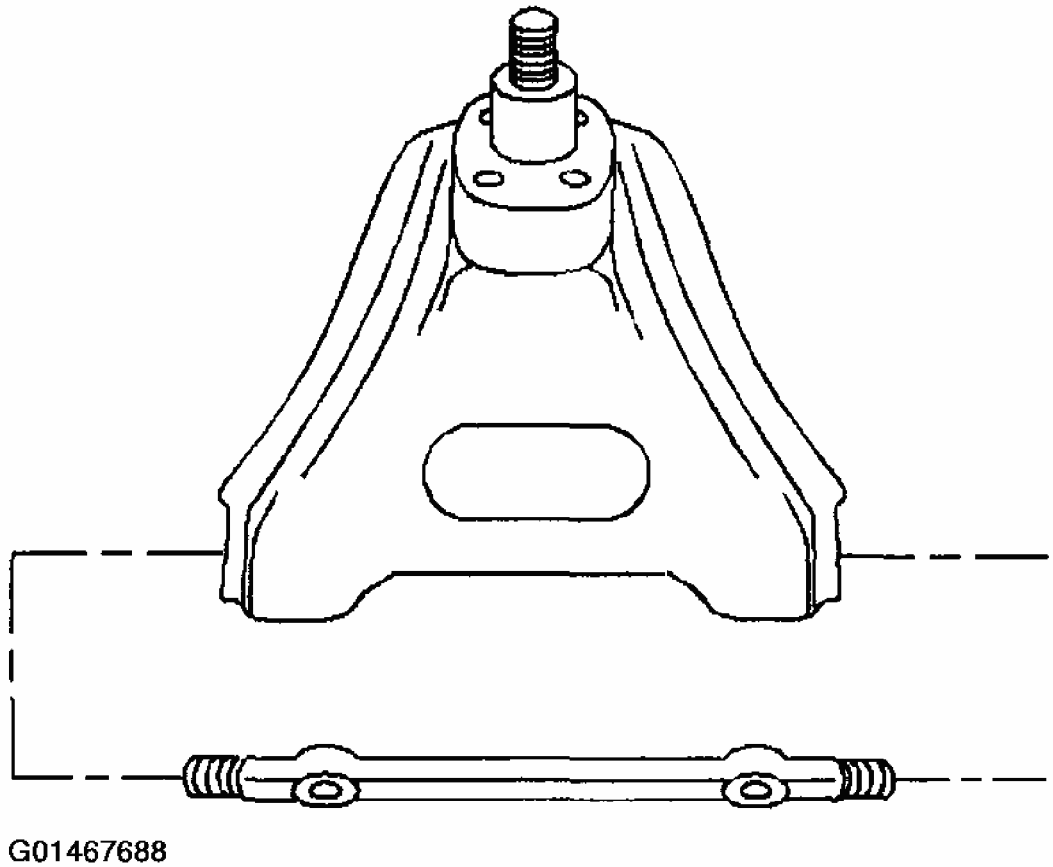

Fig. 70: Removing Upper Control Arm Shaft From Upper Control Arm
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the upper control arm shaft to the upper control arm.
2. Install the control arm bushings to the upper control arm. Use the *J 22269-01* and a short piece of pipe that is the same outer diameter as the rubber bushing.

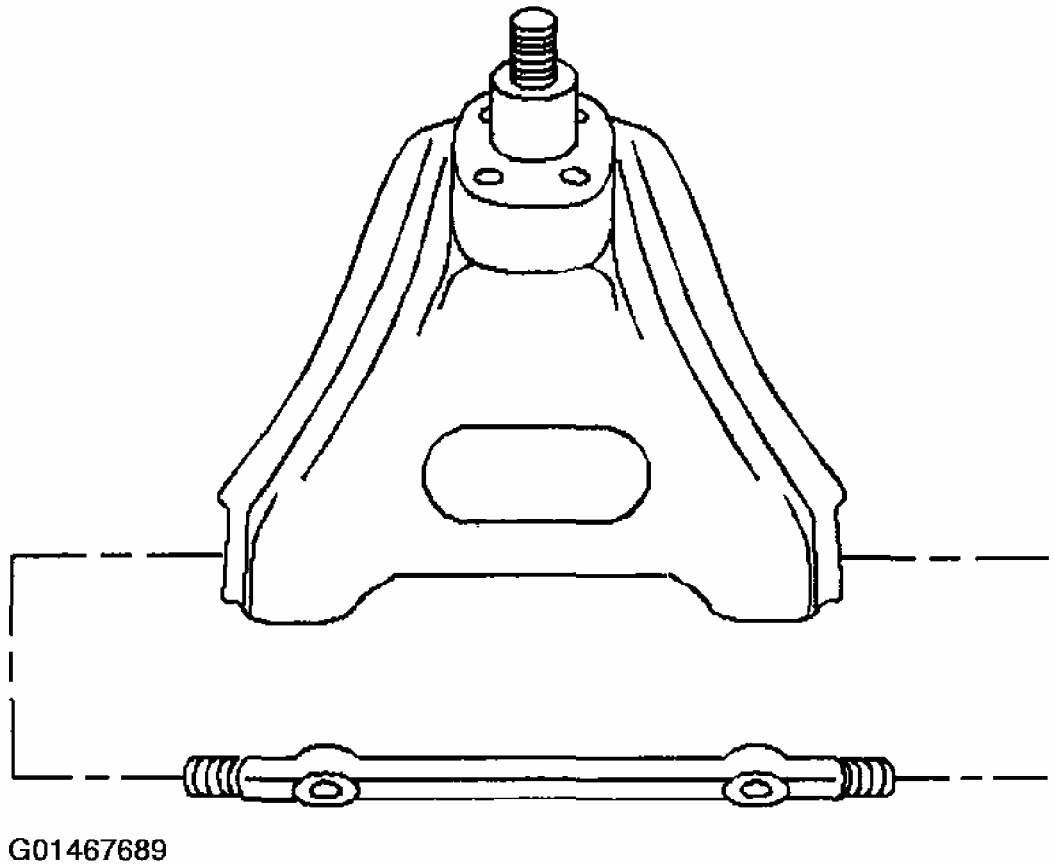

Fig. 71: Installing Upper Control Arm Shaft To Upper Control Arm
Courtesy of GENERAL MOTORS CORP.

3. Tighten *J 22269-01* until the bushing is positioned on the shaft and the upper control arm as shown. The measurement should be 12.8-13.8 mm (0.48-0.52 in) on both ends.

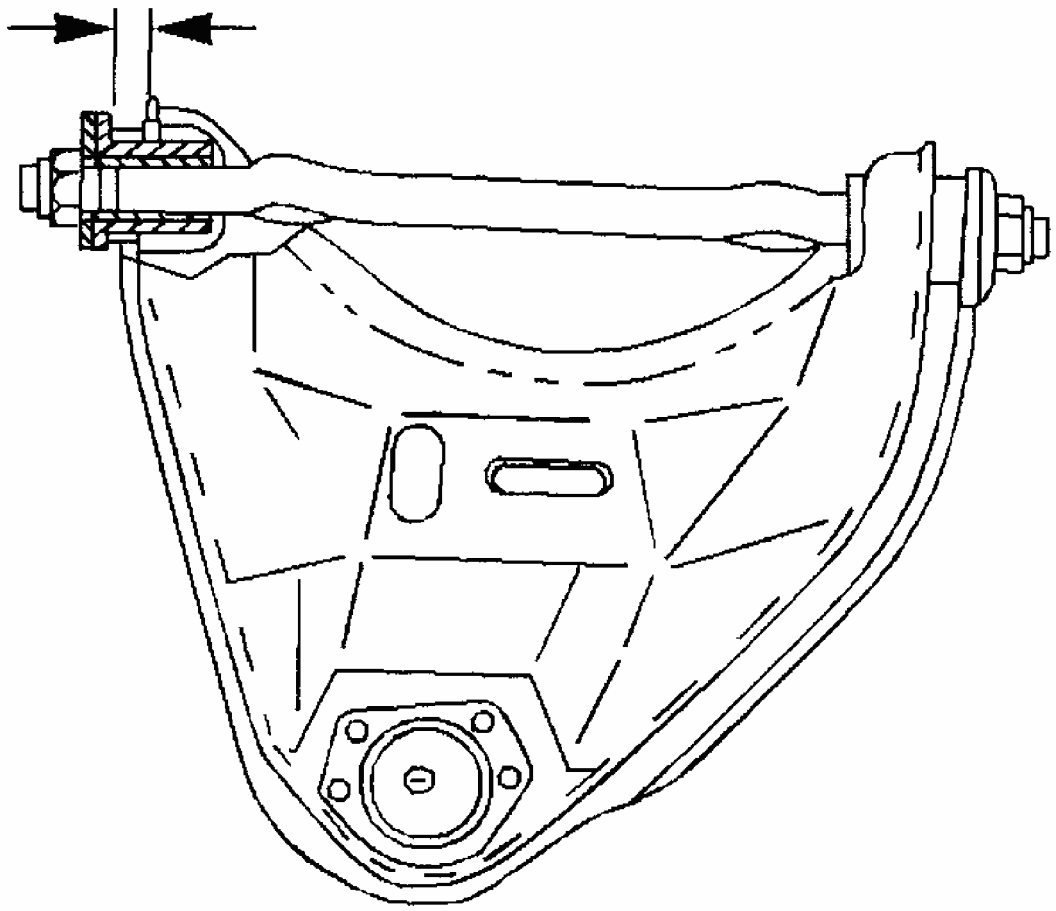

Fig. 72: Upper Control Arm Bushings
Courtesy of GENERAL MOTORS CORP.

4. Install the washers and the nuts to the upper control arm shaft. Do not tighten the nuts.
5. Remove the upper control arm from the vise.
6. Install the upper control arm to the vehicle. Refer to **UPPER CONTROL ARM REPLACEMENT (RWD)** or **UPPER CONTROL ARM REPLACEMENT (4WD)** .

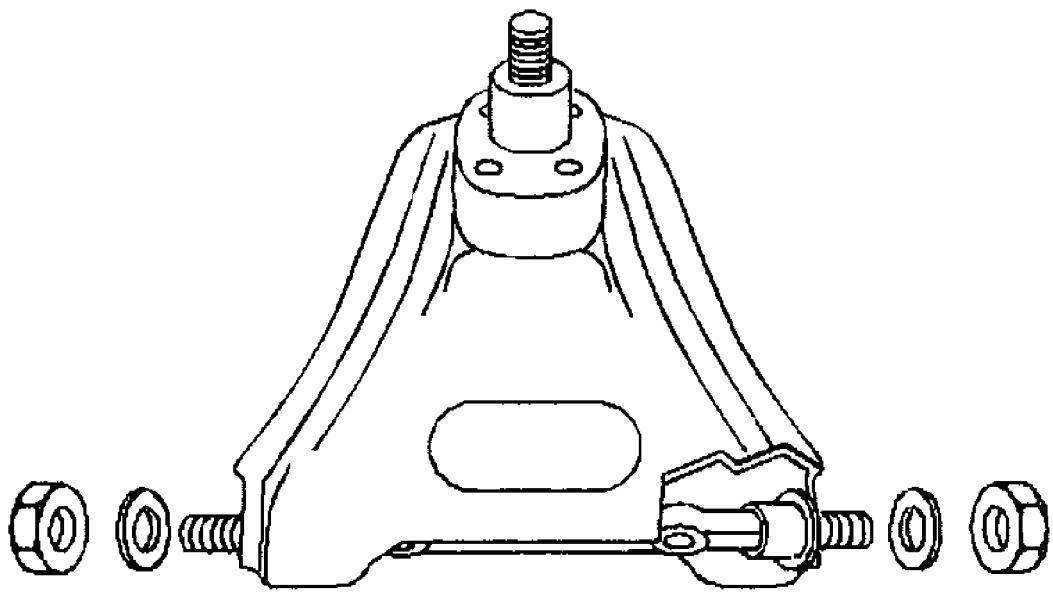

Fig. 73: Installing Washers & Nuts To Upper Control Arm Shaft
Courtesy of GENERAL MOTORS CORP.

UPPER CONTROL ARM BUSHINGS REPLACEMENT (4WD)

Tools Required

J 21474-01 Control Arm Bushing Service Set

Removal Procedure

1. Remove the upper control arm. Refer to **UPPER CONTROL ARM REPLACEMENT (RWD)** or **UPPER CONTROL ARM REPLACEMENT (4WD)** .
2. Install the upper control arm in a vise.
3. Remove the upper control arm bushings using *J 21474-01* .

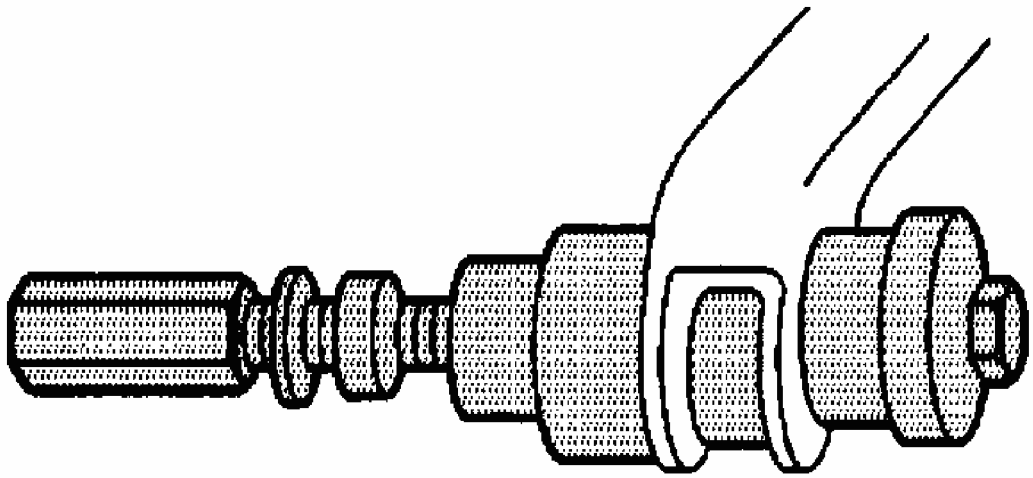

Fig. 74: Upper Control Arm Bushings
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the upper control arm bushings using *J 21474-01* .
2. Remove the upper control arm from the vise.
3. Install the upper control arm. Refer to **UPPER CONTROL ARM REPLACEMENT (RWD)** or **UPPER CONTROL ARM REPLACEMENT (4WD)** .

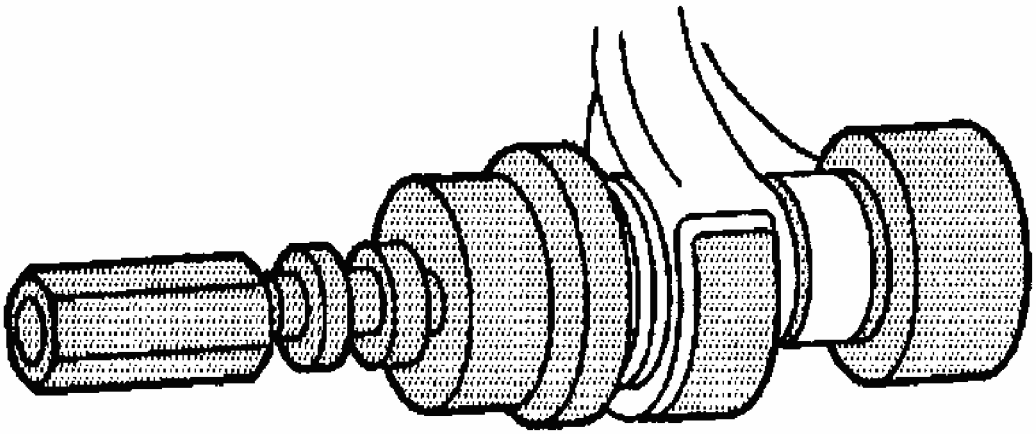

Fig. 75: Upper Control Arm Bushings
Courtesy of GENERAL MOTORS CORP.

LOWER CONTROL ARM REPLACEMENT (RWD)

Removal Procedure

1. Remove the front coil spring. Refer to **FRONT COIL SPRINGS REPLACEMENT** .
2. Remove the lower ball joint from the steering knuckle. Refer to **LOWER BALL JOINT REPLACEMENT (RWD)** or **LOWER BALL JOINT REPLACEMENT (4WD)** .
3. Remove the lower control arm from the vehicle.
4. Remove the lower control arm bumper nut.
5. Remove the lower control arm bumper.
6. Inspect the lower ball joint for wear, replace as necessary.

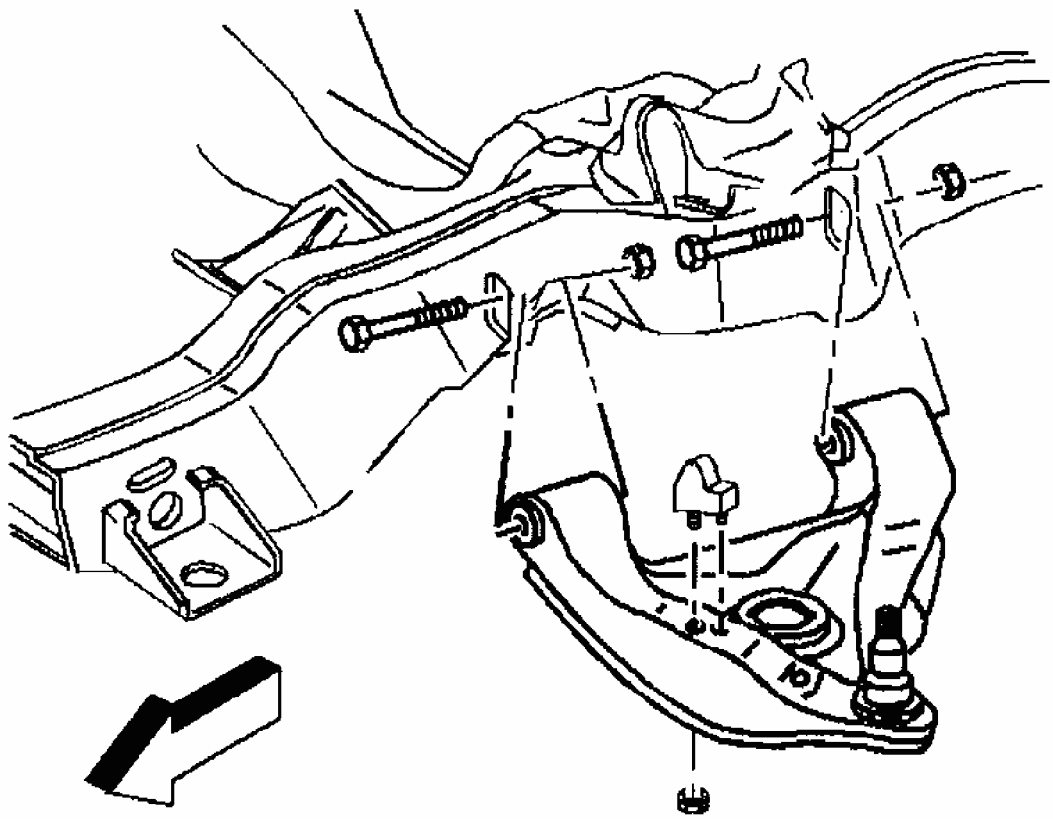

Fig. 76: Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the lower control arm bumper.

   NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Install the lower control arm bumper nut

   Tighten

   Tighten the nut to 25 N.m (18 lb ft).

3. Install the lower control arm to the vehicle.
4. Install the lower ball joint stud to the steering knuckle. Refer to **LOWER BALL JOINT REPLACEMENT (RWD)** or **LOWER BALL JOINT REPLACEMENT (4WD)** .

5. Install the front coil spring. Refer to **FRONT COIL SPRINGS REPLACEMENT** .
6. Check the front wheel alignment. Adjust if necessary. Refer to **MEASURING WHEEL ALIGNMENT** in Wheel Alignment.

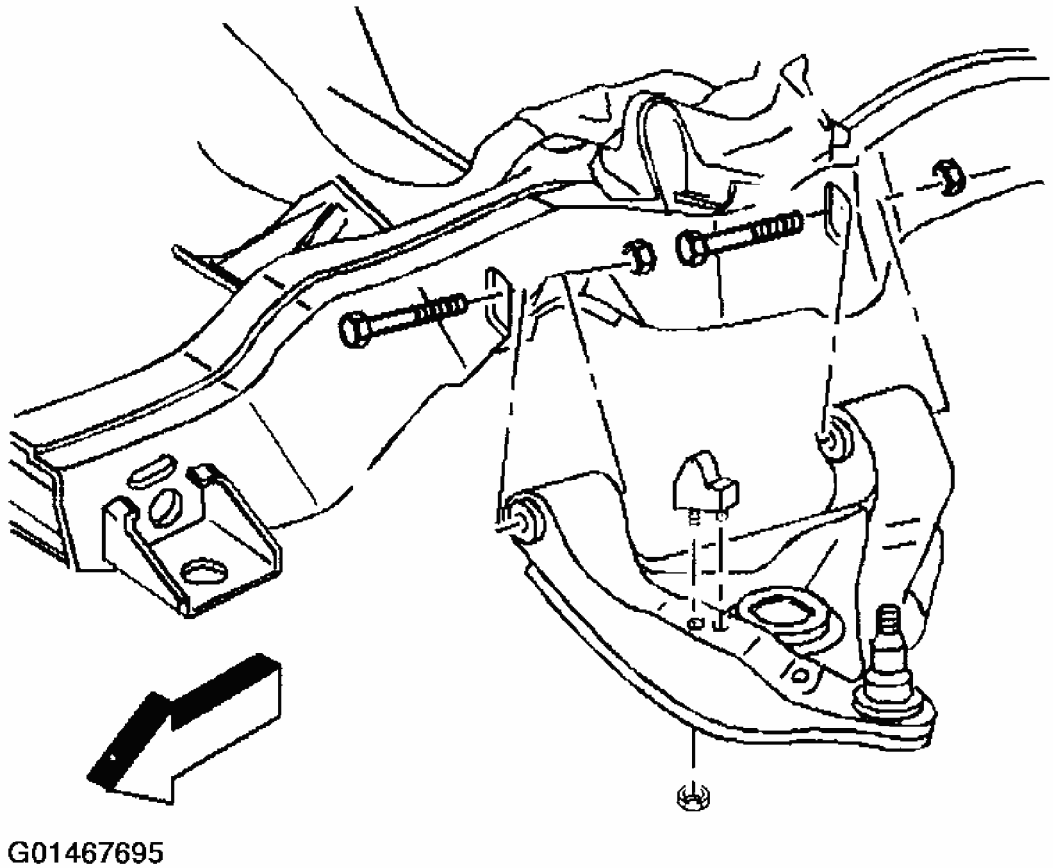

Fig. 77: Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

LOWER CONTROL ARM REPLACEMENT (4WD)

Removal Procedure

1. Raise and support the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the tire and the wheel. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
3. Remove the torsion bar from the lower control arm. Refer to **TORSION BAR AND SUPPORT ASSEMBLY REPLACEMENT** .
4. Remove the steering linkage shield. Refer to **STEERING LINKAGE SHIELD**

REPLACEMENT in Steering Linkage.

5. Remove the stabilizer shaft link from the lower control arm. Refer to **STABILIZER SHAFT LINK REPLACEMENT (RWD)** or **STABILIZER SHAFT LINK REPLACEMENT (4WD)** .
6. Remove the stabilizer shaft bracket bolts.
7. Lower the stabilizer shaft.
8. Remove the shock absorber lower mounting bolt.
9. Compress shock absorber.
10. Remove the steering knuckle. Refer to **STEERING KNUCKLE REPLACEMENT (RWD)** or **STEERING KNUCKLE REPLACEMENT (4WD)** .

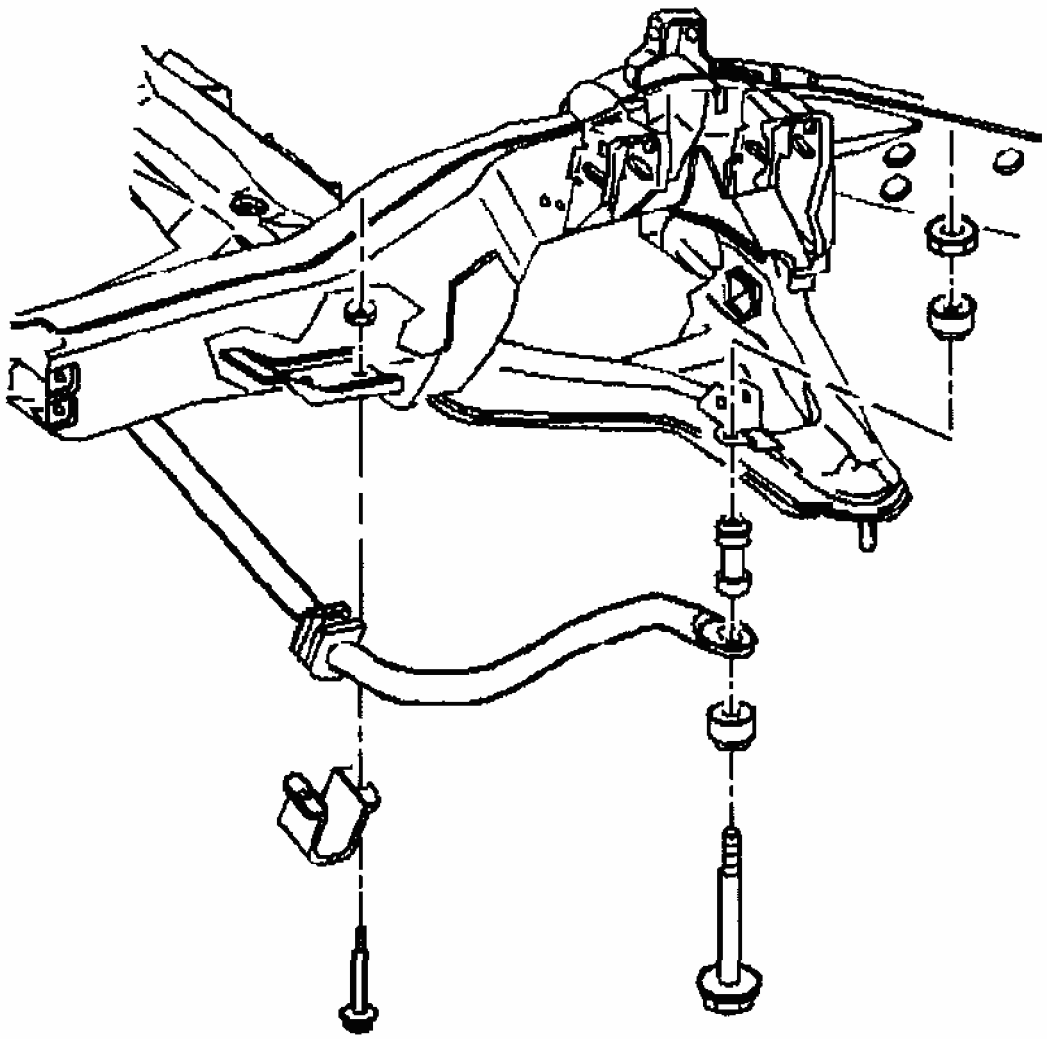

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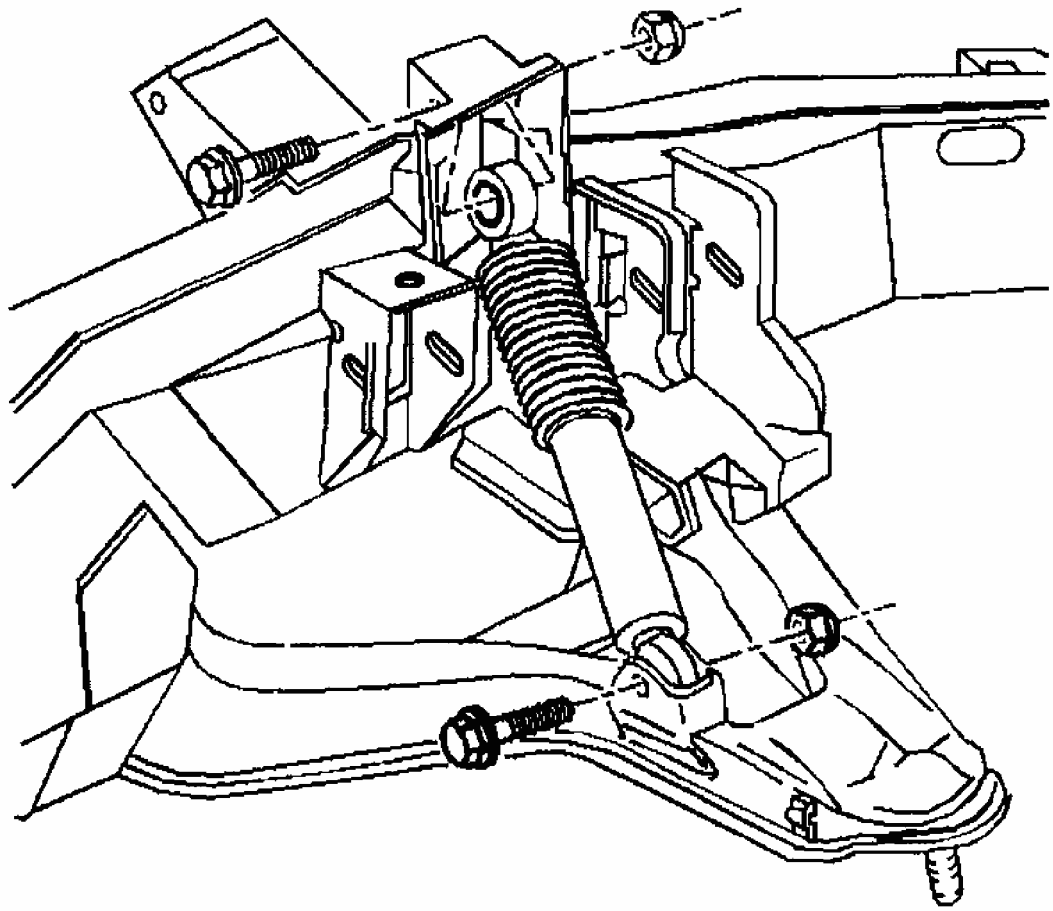
Fig. 78: Lowering Stabilizer Shaft

Courtesy of GENERAL MOTORS CORP.



G01467697

Fig. 79: Shock Absorber Lower Mounting Bolt
Courtesy of GENERAL MOTORS CORP.

11. Remove the lower control arm to the crossmember and the frame bracket mounting nuts and bolts.
12. Remove the lower control arm from the frame.

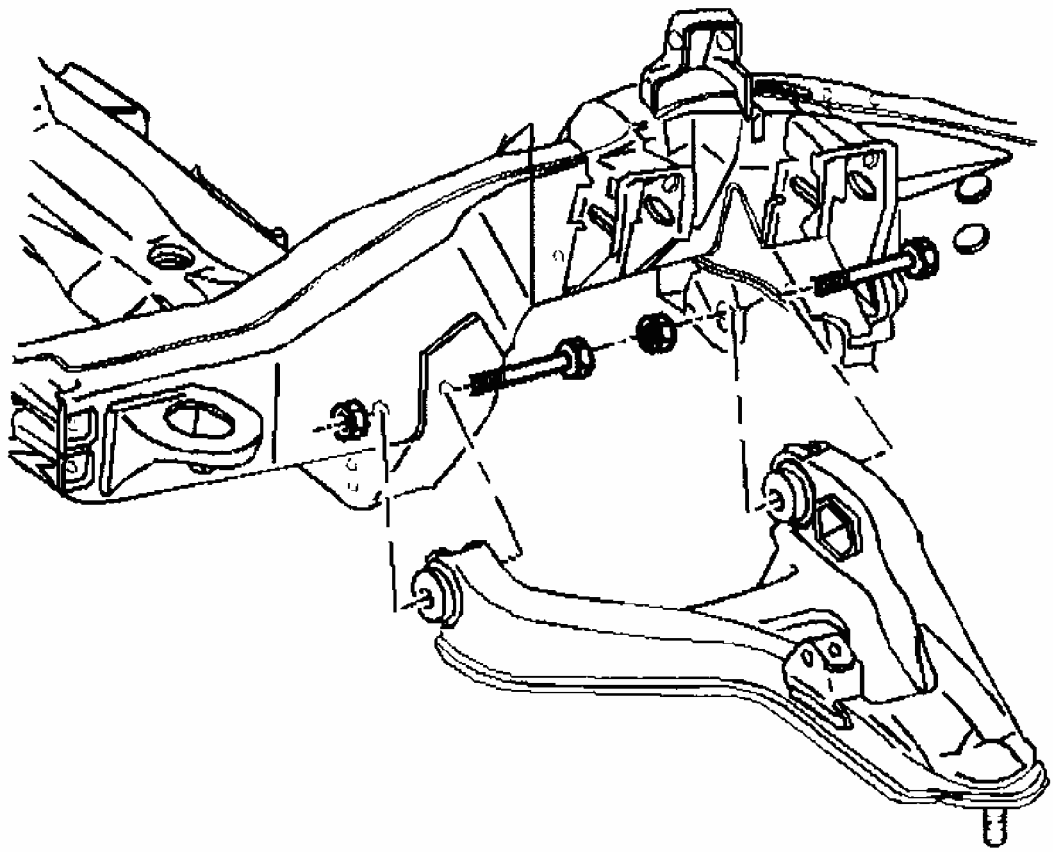


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Fig. 80: Removing Lower Control Arm From Frame
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

Important: Install the front leg of the lower control arm into the crossmember before installing the rear leg into the frame bracket.

1. Install the lower control arm to the crossmember and to the frame bracket.
2. Install the lower control arm mounting bolts in the direction shown.

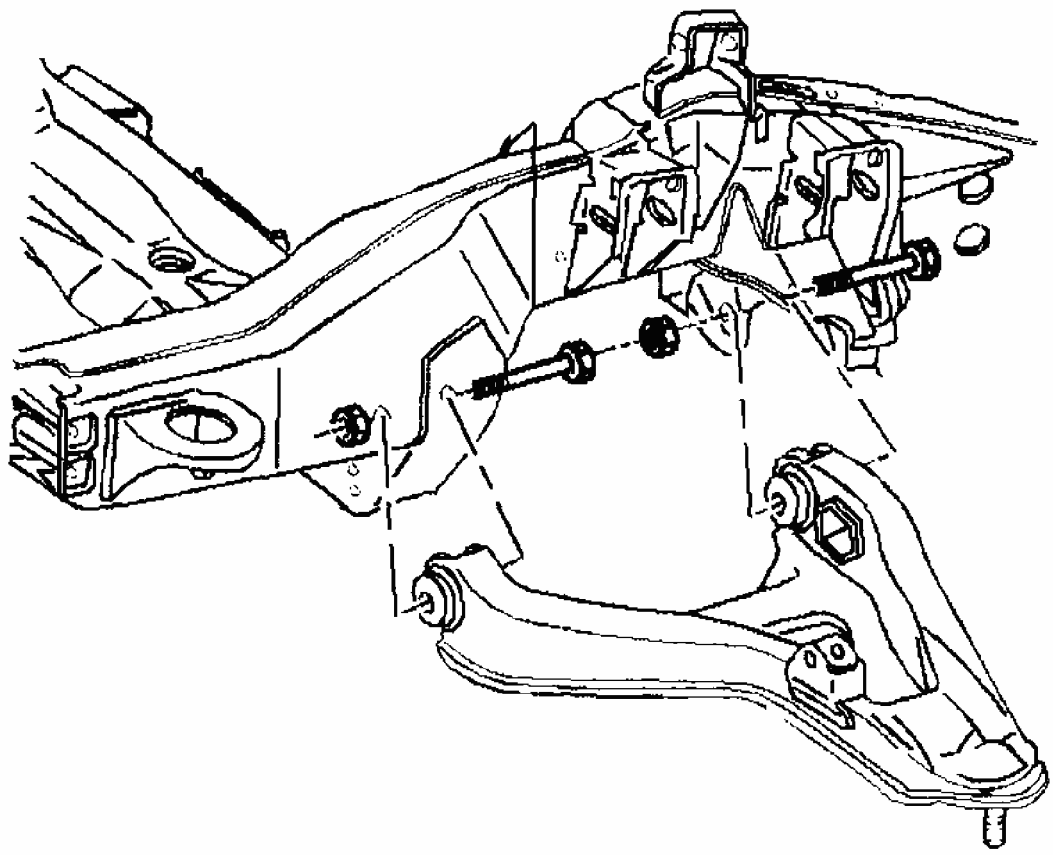

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Fig. 81: Installing Lower Control Arm To Crossmember & To Frame Bracket
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

Important:

- Tighten the nuts with the lower control arm at the proper trim height. Refer to **TRIM HEIGHT INSPECTION PROCEDURE** in Suspension General Diagnosis.
- Tighten the nuts and the bolts with the front suspension loaded.

3. Install the lower control arm mounting nuts.

Tighten

Tighten the lower control arm front nut and the rear nut to 110 N.m (81 lb ft).

4. Install the steering knuckle. Refer to **STEERING KNUCKLE REPLACEMENT**

(RWD) or **STEERING KNUCKLE REPLACEMENT (4WD)** .

5. Install the shock absorber lower mounting bolt.

Tighten

Tighten the shock absorber lower mounting bolt to 73 N.m (54 lb ft).

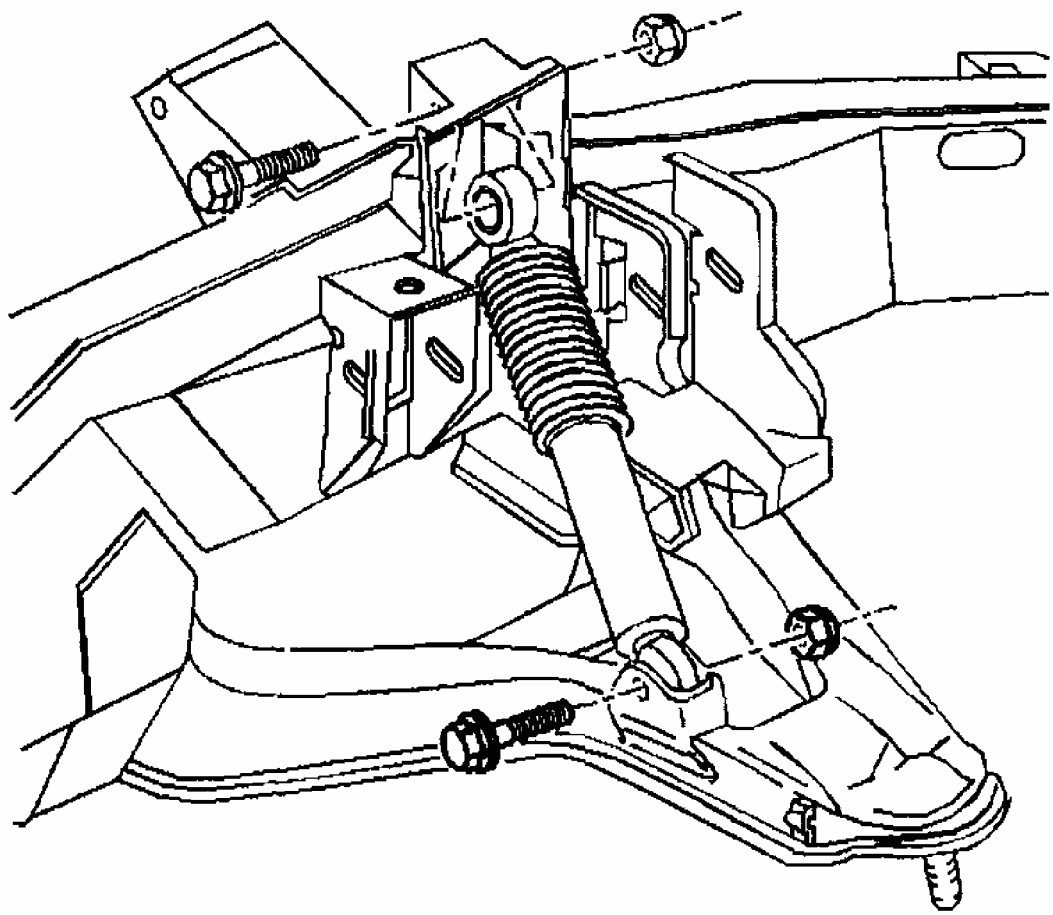

Fig. 82: Shock Absorber Lower Mounting Bolt
Courtesy of GENERAL MOTORS CORP.

6. Raise the stabilizer shaft.
7. Install the stabilizer shaft bracket bolts.

Tighten

Tighten the stabilizer shaft bracket bolts to 65 N.m (48 lb ft).

8. Install the stabilizer shaft link to the lower control arm. Refer to **STABILIZER SHAFT LINK REPLACEMENT (RWD)** or **STABILIZER SHAFT LINK REPLACEMENT (4WD)** .
9. Install the steering linkage shield. Refer to **STEERING LINKAGE SHIELD REPLACEMENT** in Steering Linkage.
10. Install the torsion bar. Refer to **TORSION BAR AND SUPPORT ASSEMBLY REPLACEMENT** .
11. Install the tire and the wheel. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
12. Lower the vehicle.
13. Check the front wheel alignment. Refer to **MEASURING WHEEL ALIGNMENT** in Wheel Alignment.

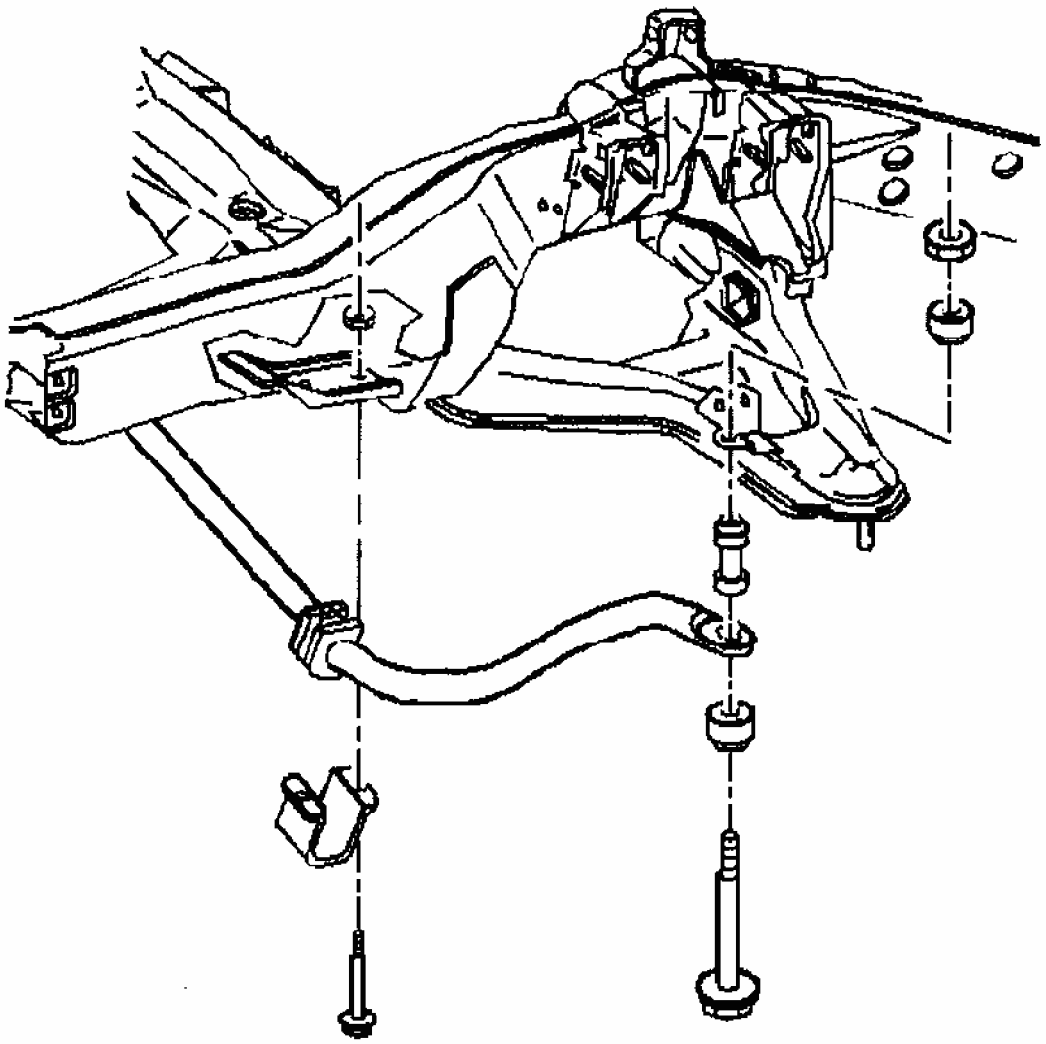

Fig. 83: Installing Stabilizer Shaft Link To Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

LOWER CONTROL ARM BUSHINGS REPLACEMENT (RWD)

Tools Required

- *J 21474-01* Control Arm Bushing Service Set
- *J 22269-01* Accumulator and Servo Piston Remover

Removal Procedure

1. Remove the lower control arm from the vehicle. Refer to **LOWER CONTROL ARM REPLACEMENT (RWD)** or **LOWER CONTROL ARM REPLACEMENT**

(4WD) .

2. Install the lower control arm in a vise.
3. Remove the rear bushing.
   3.1 Install the following tools:
   - The *J 22269-01*
   - The *J 21474-8*
   - The *J 21474-12*
   - The *J 21474-13*

   3.2 Tighten until the rear bushing becomes free.

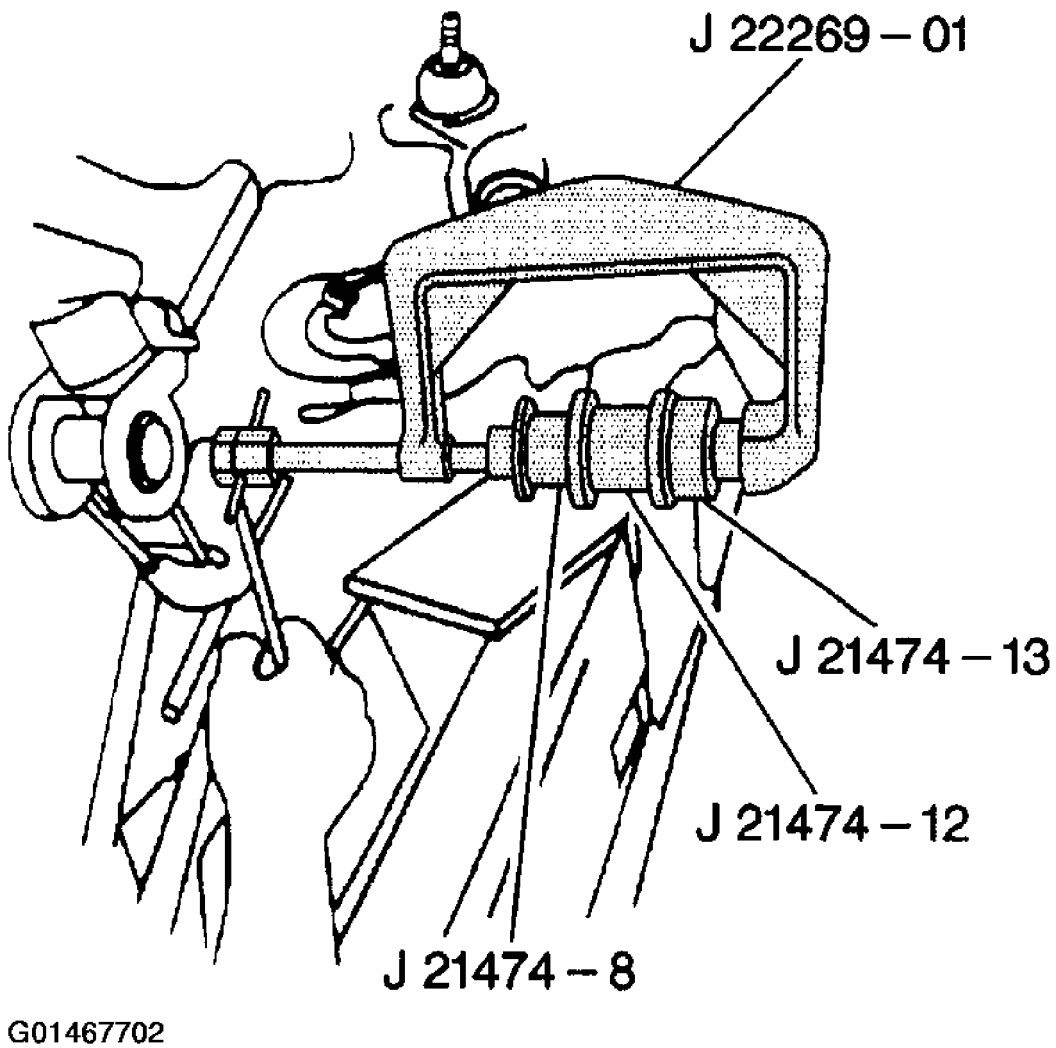

Fig. 84: Rear Bushing
Courtesy of GENERAL MOTORS CORP.

4. Using a blunt chisel, drive the front bushing flare down flush with the rubber part of the bushing.
5. Prior to removing or installing the front bushing, place a wedge or spacer between the control arm bushing housing. This keeps the control arm bushing housing from bending while removing or installing the bushing.
6. Remove the front bushing.
    6.1 Install the following tools:
    - The *J 21474-3*
    - The *J 21474-4*
    - The *J 21474-5*
    - The *J 21474-6*

    6.2 Tighten until the bushing is partially removed.
    6.3 Reverse the *J 21474-6* .
    6.4 Tighten until the front bushing becomes free.

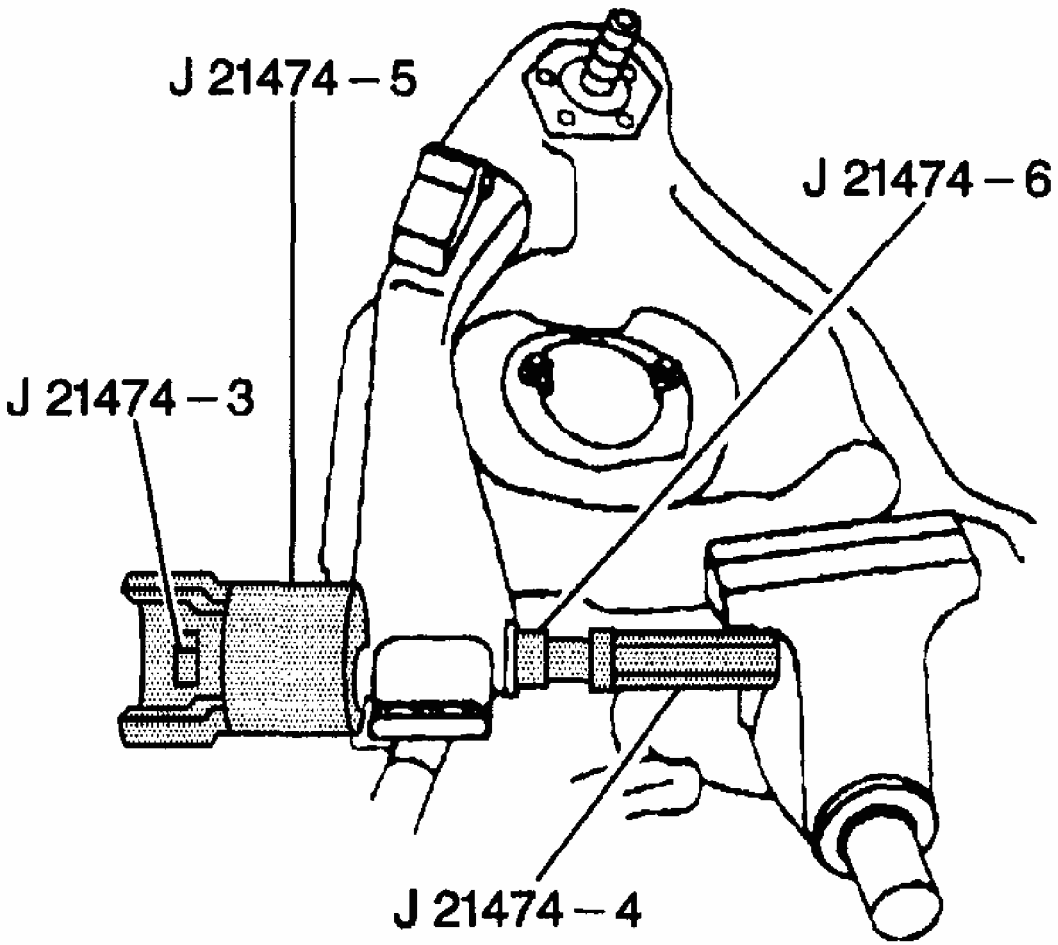

Fig. 85: Front Bushing
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Prior to removing or installing the bushing, place a wedge or spacer between the control arm bushing housing. This keeps the control arm bushing housing from bending while removing or installing the bushing.
2. Install the front bushing into the lower control arm.
3. Install the *J 21474-4* , the *J 21474-5* , and the *J 21474-13* .

   The lip is on the outside of the control arm.

4. Tighten until the front bushing seats fully into the lower control arm. Remove the tools.

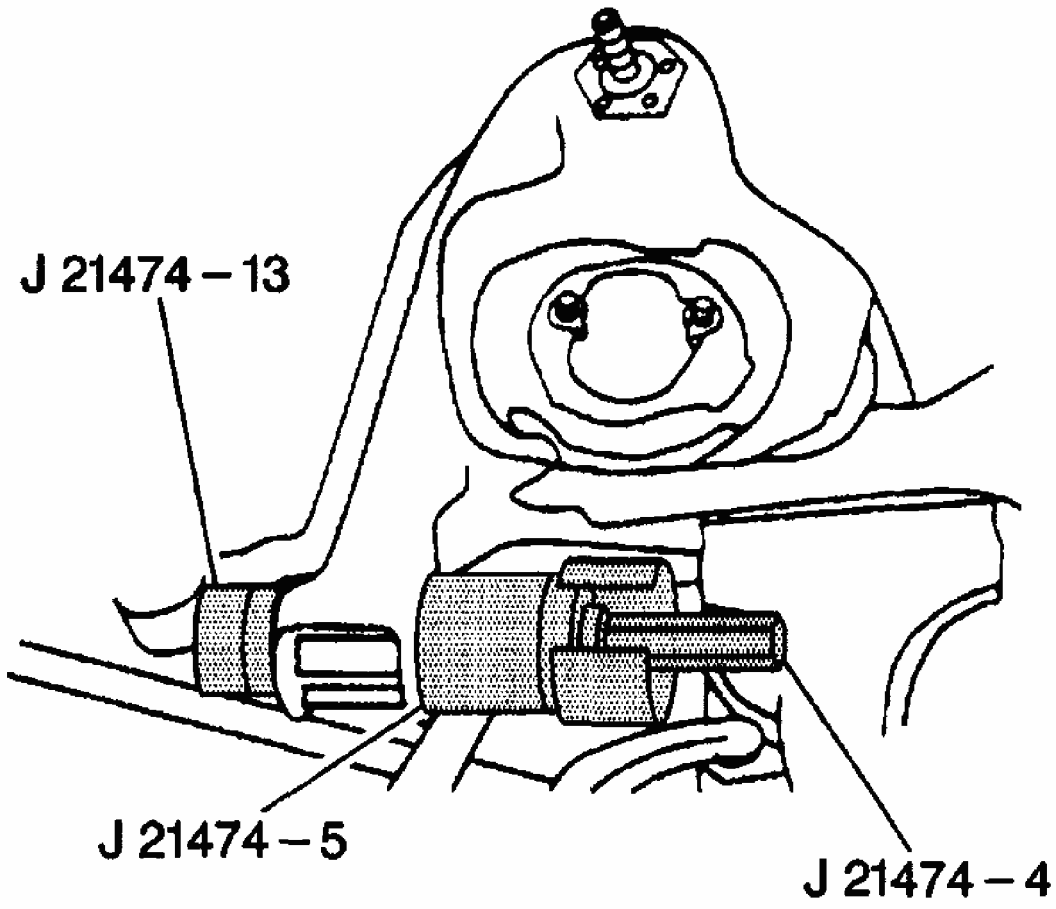

Fig. 86: Installing Front Bushing Into Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

5. Install the rear bushing into the lower control arm.
   5.1 Install the *J 22269-1* , the *J 21474-2* , and the *J 21474-13* .

   The lip is on the outside of the control arm.

   5.2 Tighten until the rear bushing seats fully into the lower control arm. Remove the tools.
6. Remove the lower control arm from the vise.
7. Install the lower control arm to the vehicle. Refer to **LOWER CONTROL ARM REPLACEMENT (RWD)** or **LOWER CONTROL ARM REPLACEMENT (4WD)** .

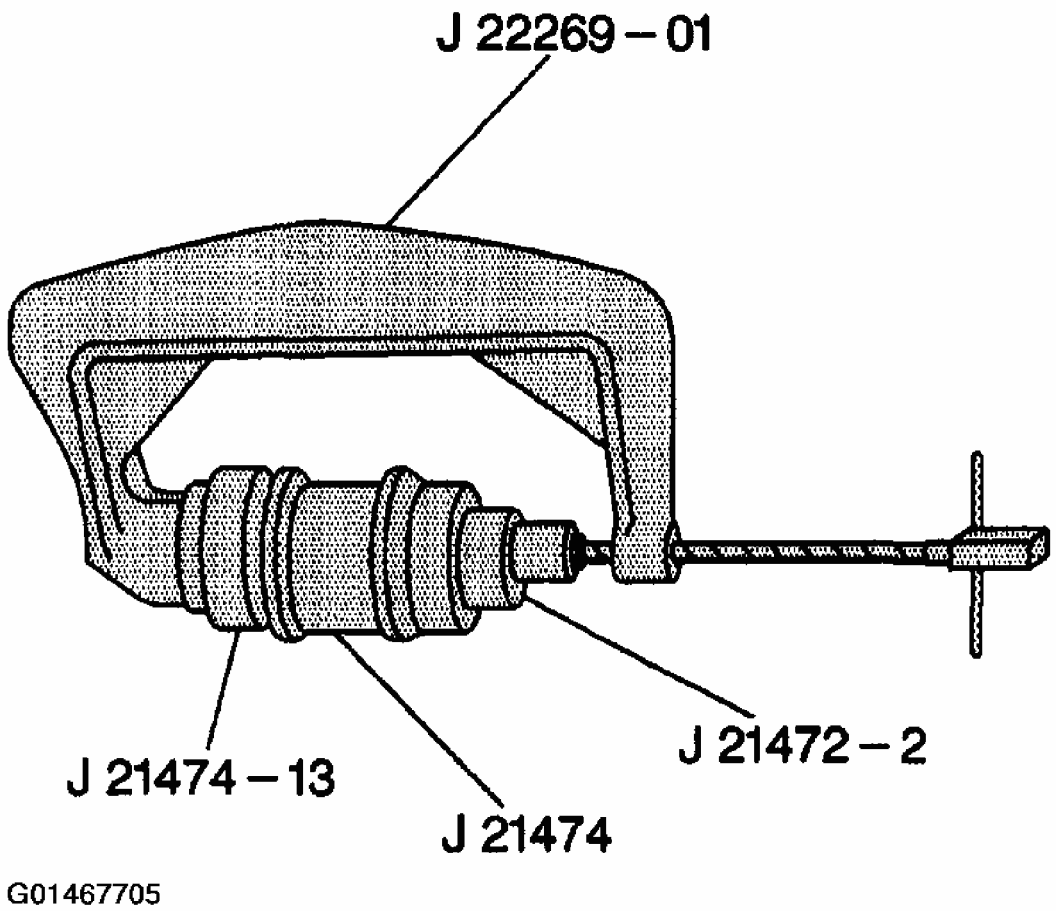

Fig. 87: Installing Rear Bushing Into Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

LOWER CONTROL ARM BUSHINGS REPLACEMENT (4WD)

Tools Required

J 21474-01 Control Arm Bushing Service Set

Removal Procedure

1. Remove the lower control arm. Refer to **LOWER CONTROL ARM REPLACEMENT (RWD)** or **LOWER CONTROL ARM REPLACEMENT (4WD)** .
2. Remove the front bushing. Use the *J 21474-01* .

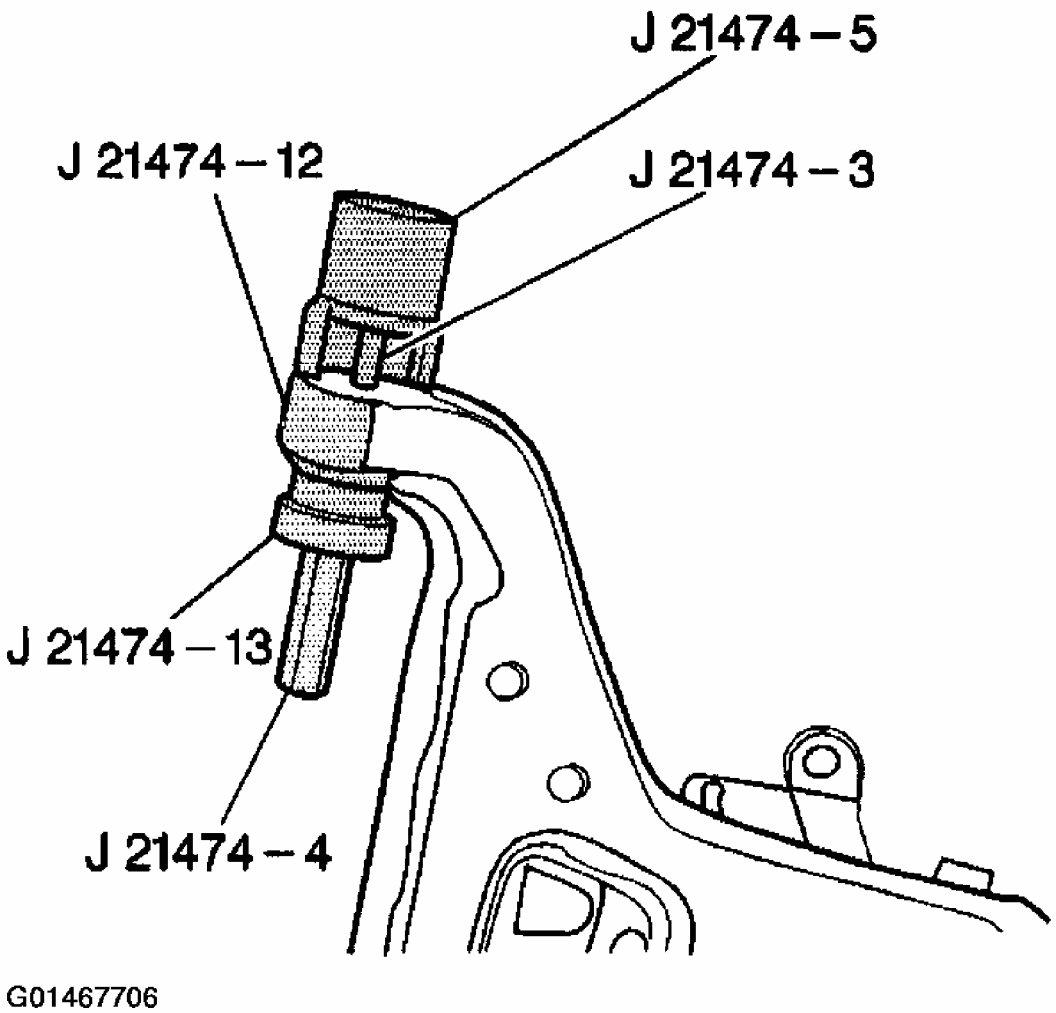

Fig. 88: Front Bushing
Courtesy of GENERAL MOTORS CORP.

3. Remove the rear bushing. Use the *J 21474-01*

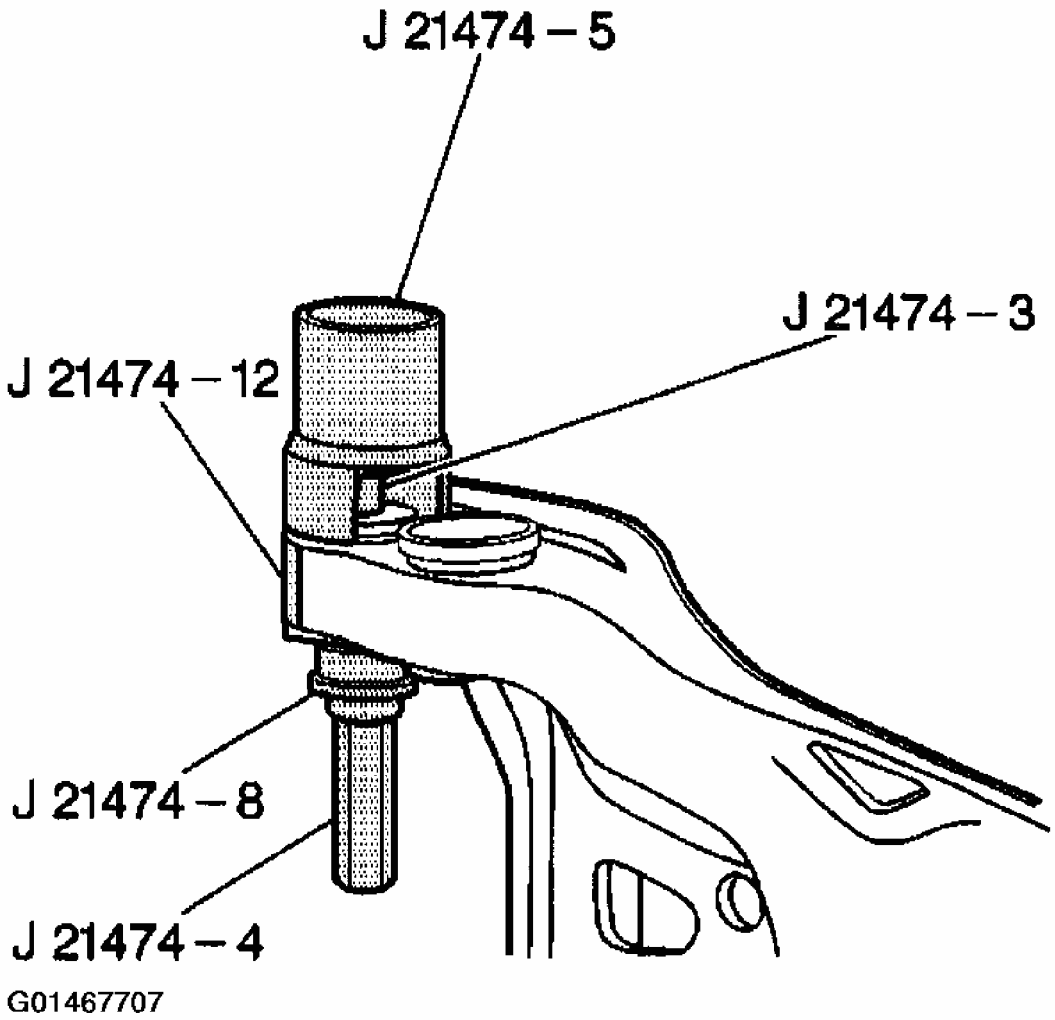

Fig. 89: Rear Bushing
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the front bushing. Use the *J 21474-01*

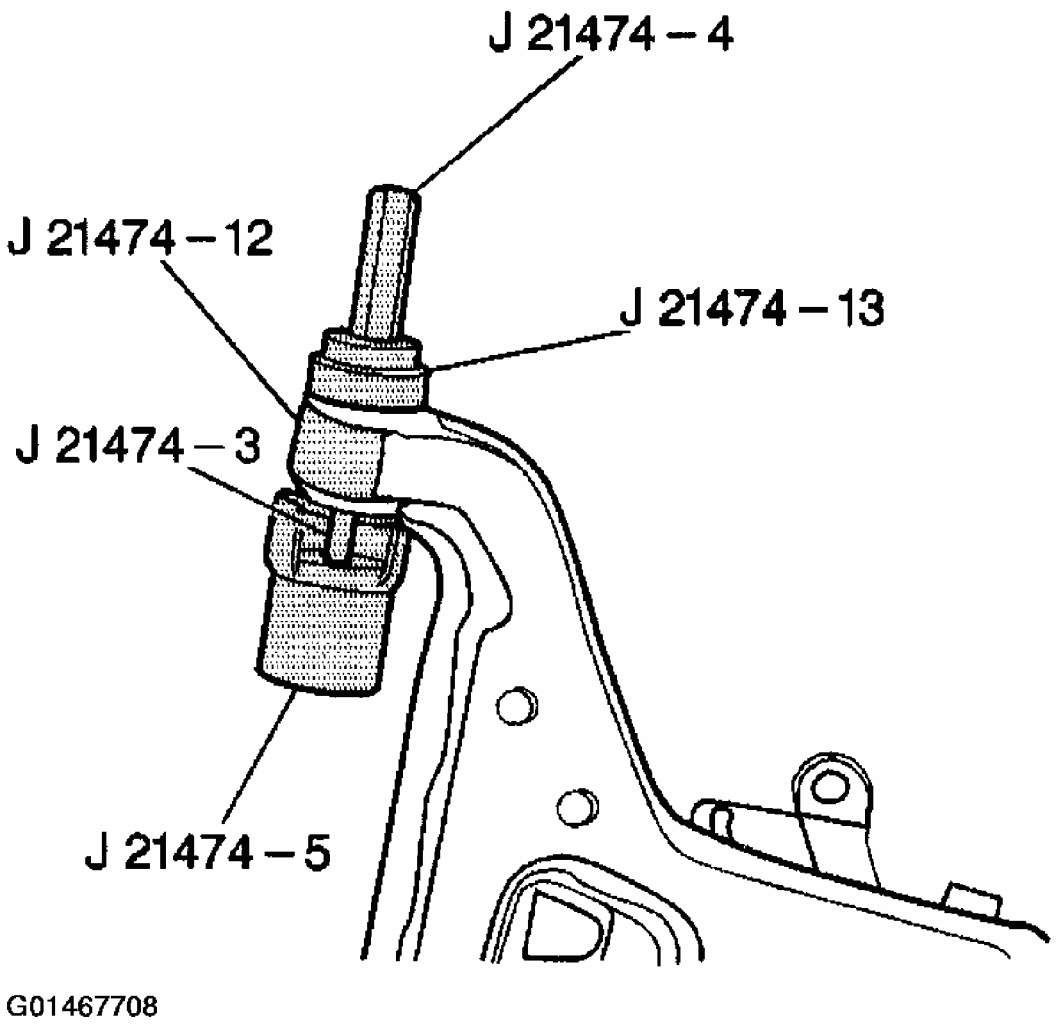

Fig. 90: Front Bushing
Courtesy of GENERAL MOTORS CORP.

2. Install the rear bushing. Use the *J 21474-01* .
3. Install the lower control arm. Refer to **LOWER CONTROL ARM REPLACEMENT (RWD)** or **LOWER CONTROL ARM REPLACEMENT (4WD)** .

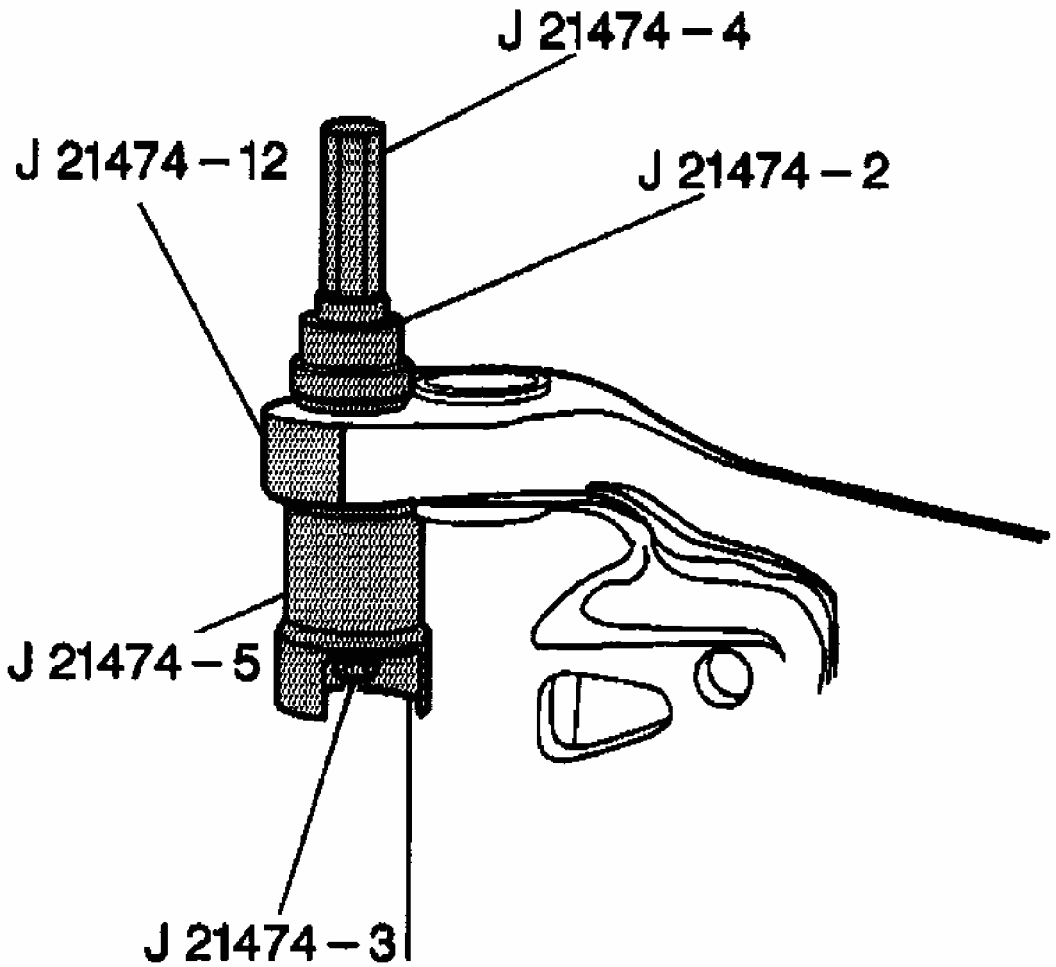

Fig. 91: Rear Bushing
Courtesy of GENERAL MOTORS CORP.

FRONT COIL SPRINGS REPLACEMENT

Tools Required

J 23028-01 Coil Spring Remover and Installer

Removal Procedure

NOTE: Use care when handling the coil springs in order to avoid chipping or scratching the coating. Damage to the coating will result in premature failure of the coil springs.

1. Remove the stabilizer shaft link from the lower control arm. Refer to **STABILIZER**

SHAFT LINK REPLACEMENT (RWD) or **STABILIZER SHAFT LINK REPLACEMENT (4WD)** .

2. Remove the shock absorber. Refer to **SHOCK ABSORBER REPLACEMENT (RWD)** or **SHOCK ABSORBER REPLACEMENT (4WD)** .
3. Secure *J 23028-01* to the end of a suitable jack.
4. Cradle the lower control arm bushings using *J 23028-01* .
5. Raise the jack in order to relieve tension on the lower control arm pivot bolts.

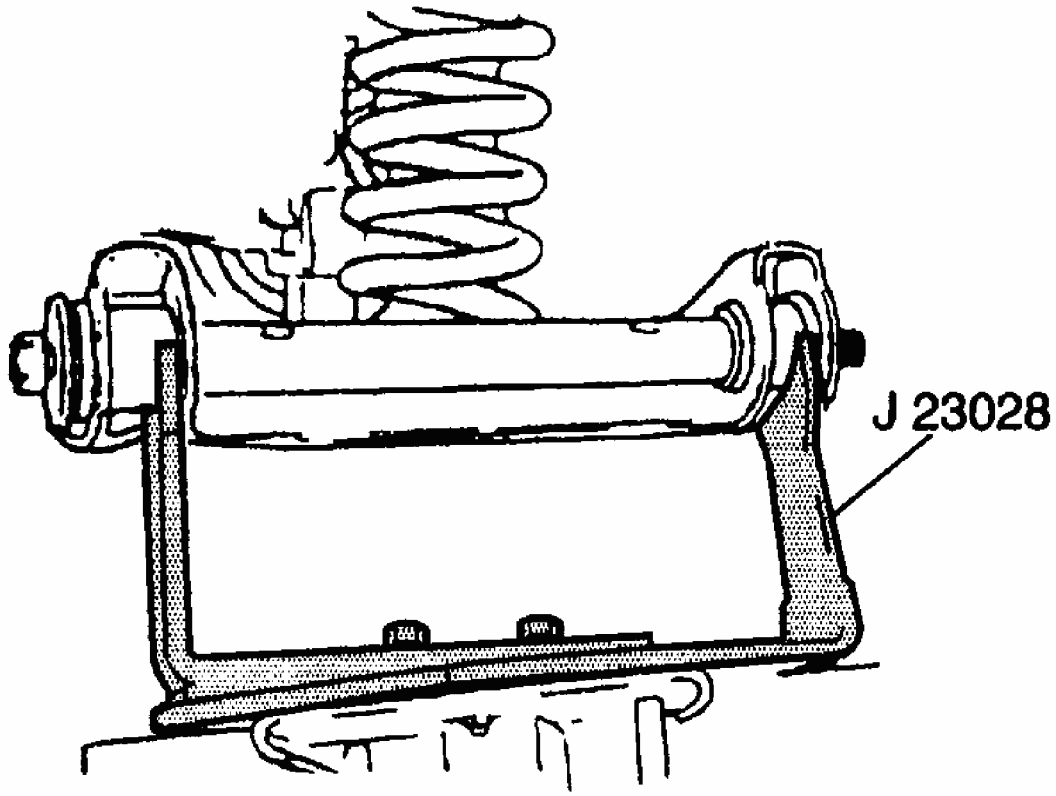

Fig. 92: Securing SST To End Of Jack
Courtesy of GENERAL MOTORS CORP.

6. Turn the steering wheel to one side in order to allow the steering linkage to clear the lower control arm front pivot bolt.
7. Remove the lower control arm pivot bolts and nuts.
    7.1 Remove the lower control arm rear pivot bolt.
    7.2 Remove the lower control arm front pivot bolt.
8. Lower *J 23028-01* slowly to relieve the tension from the front coil spring.

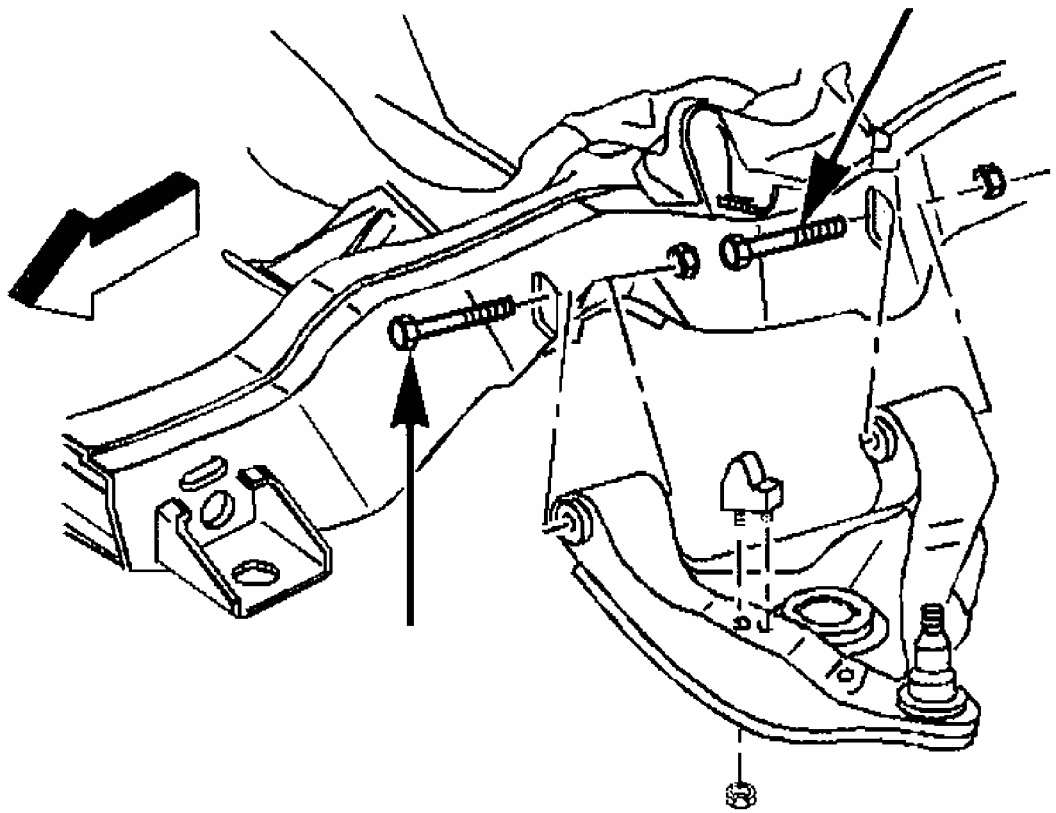

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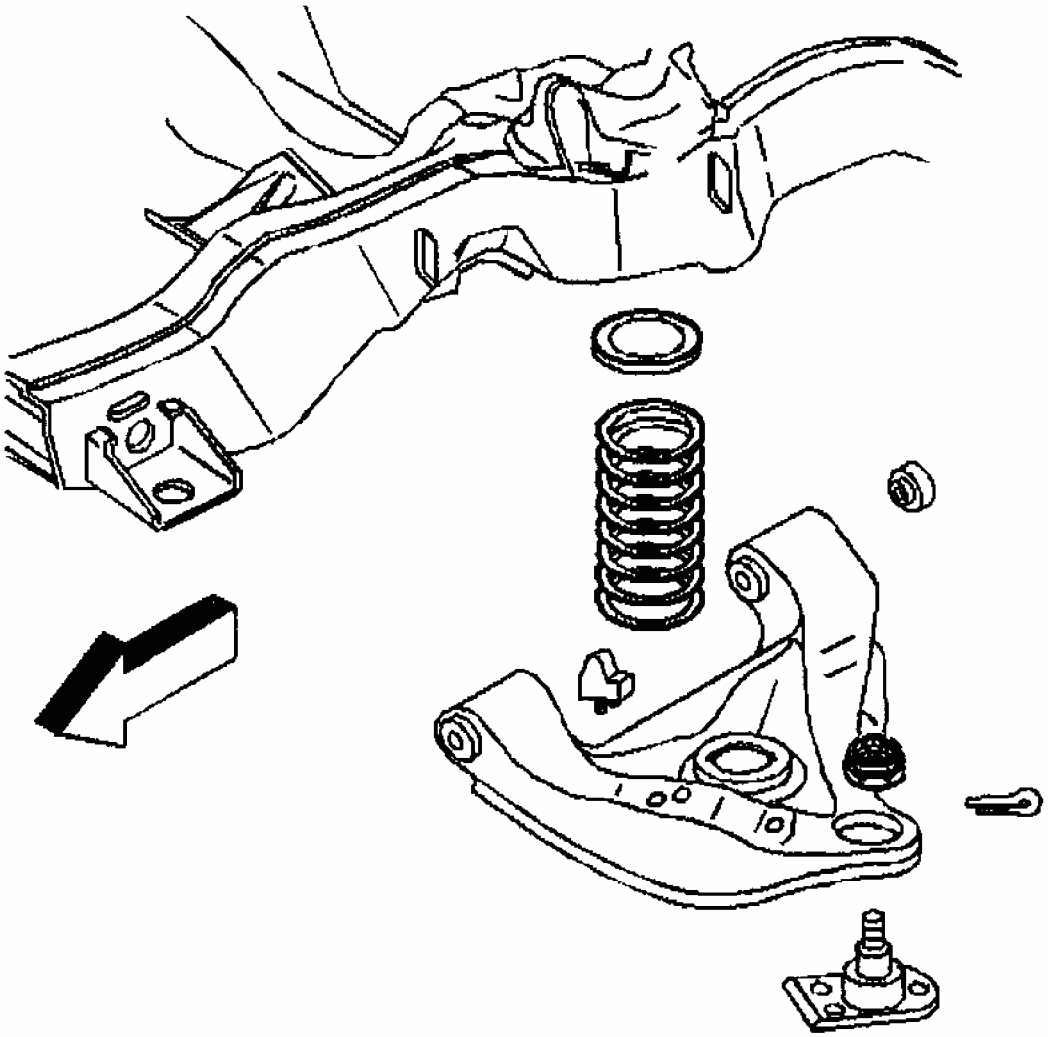
Fig. 93: Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

9. Remove the front coil spring and the insulators. While removing the front coil spring, do not apply force to the lower control arm and/or lower ball joint.



G01467712

Fig. 94: Front Coil Spring & Insulators
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the front coil spring and the insulators on the lower control arm.

   Ensure that front coil spring covers all or part of one inspection drain hole. The other hole must be partly or completely uncovered. Rotate coil spring as necessary.

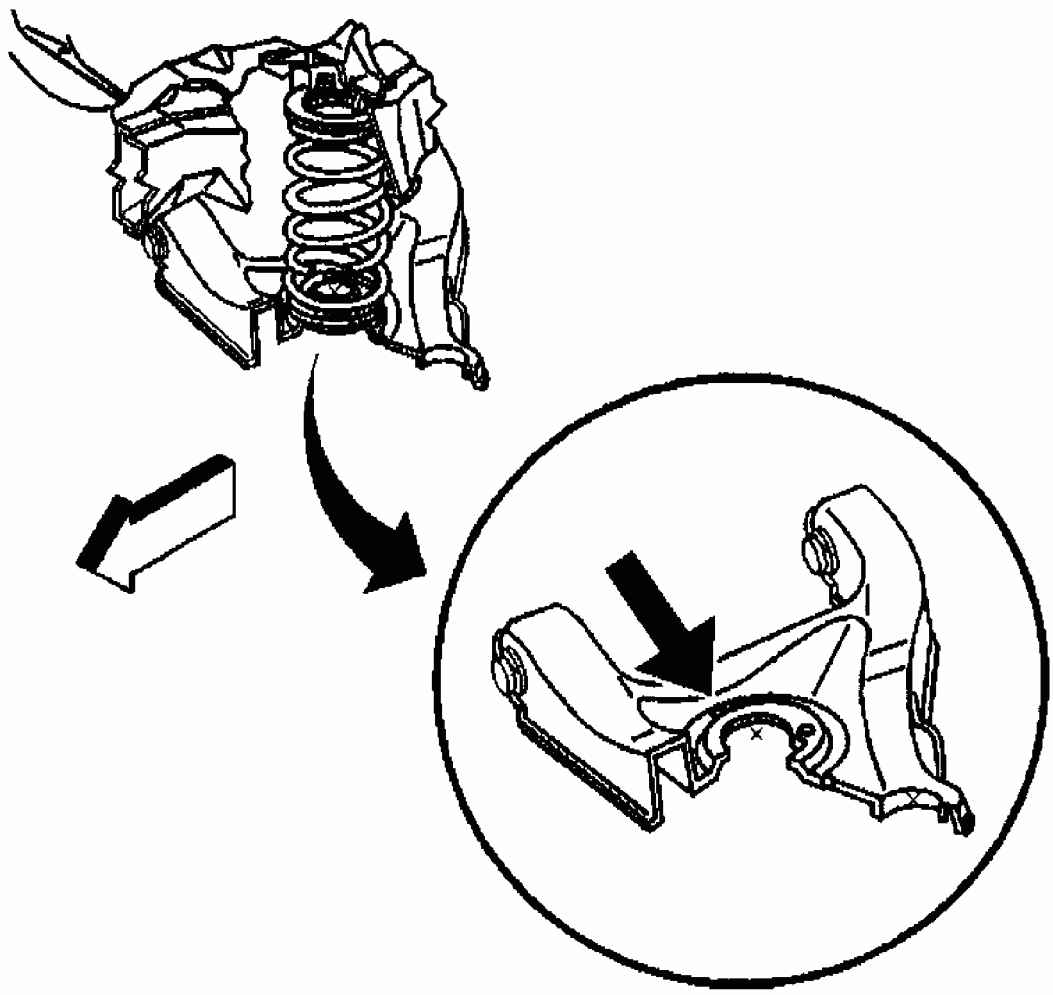


Fig. 95: Installing Front Coil Spring & Insulators On Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

2. Support the control arm using *J 23028-01* .
3. Position the coil spring and insulator in the upper spring seat on the frame.
4. Raise the lower control arm using *J 23028-01* .
5. Install the lower control arm to the frame.

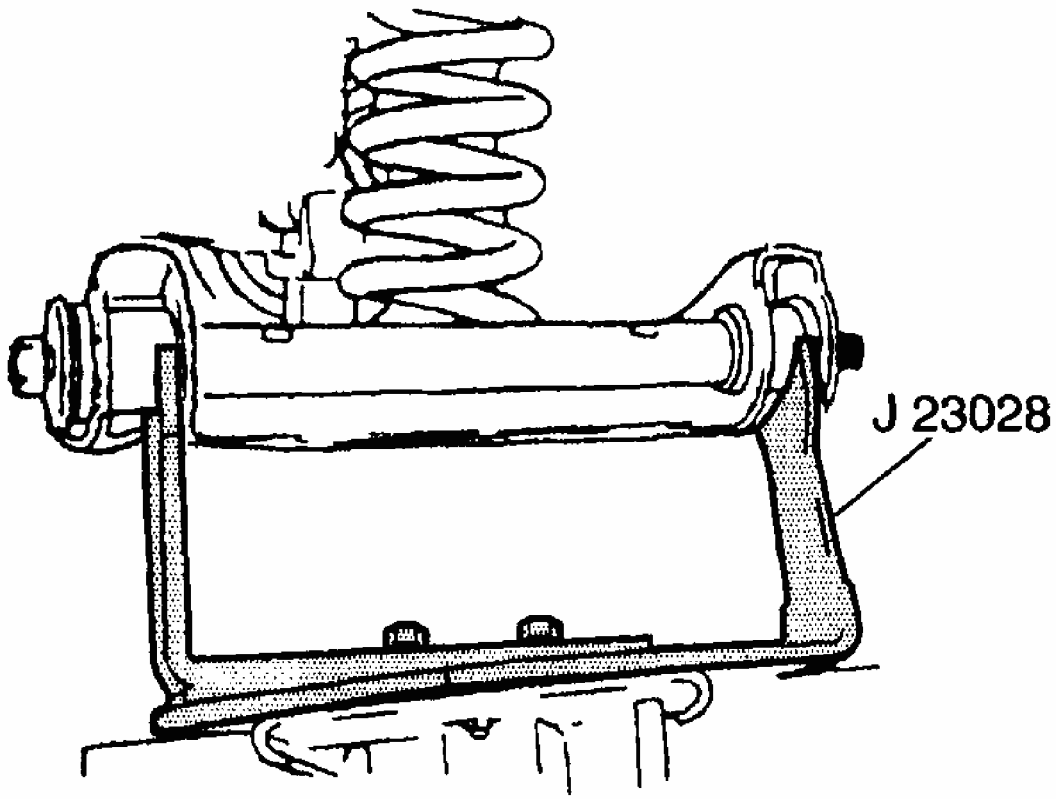


Fig. 96: Raising Lower Control Arm
Courtesy of GENERAL MOTORS CORP.

6. In order to maintain adequate steering linkage clearance, install the bolts in the direction shown.
7. Install the lower control arm front pivot bolt and the new nut.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

8. Install the lower control arm rear pivot bolt and the new nut.

Tighten

8.1 Tighten the lower control arm pivot bolts nuts with the front suspension loaded.

8.2 Tighten the lower control arm front bolt to 115 N.m (85 lb ft).

8.3 Tighten the lower control arm rear bolt to 98 N.m (72 lb ft).

9. Remove the *J 23028-01* .

10. Install the shock absorber. Refer to **SHOCK ABSORBER REPLACEMENT (RWD)** or **SHOCK ABSORBER REPLACEMENT (4WD)** .
11. Install the stabilizer shaft link to the lower control arm. Refer to **STABILIZER SHAFT LINK REPLACEMENT (RWD)** or **STABILIZER SHAFT LINK REPLACEMENT (4WD)** .
12. Check the front wheel alignment. Refer to **WHEEL ALIGNMENT SPECIFICATIONS** in Wheel Alignment.

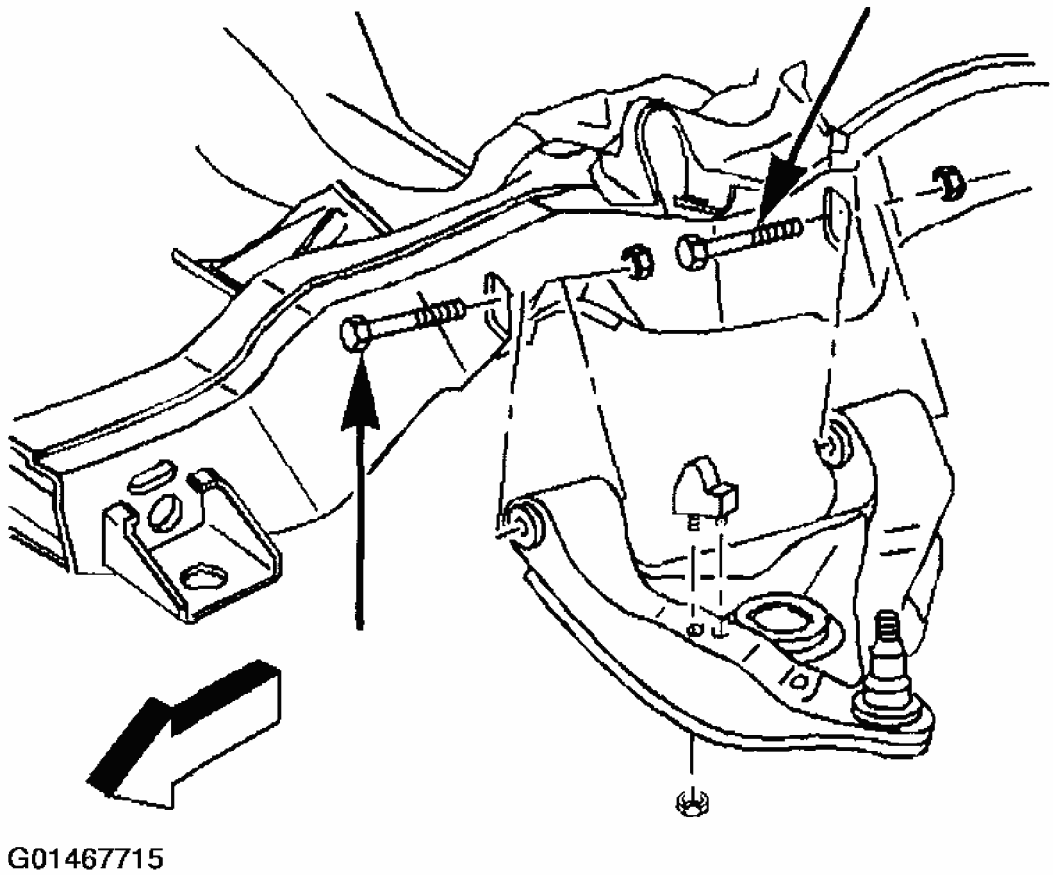


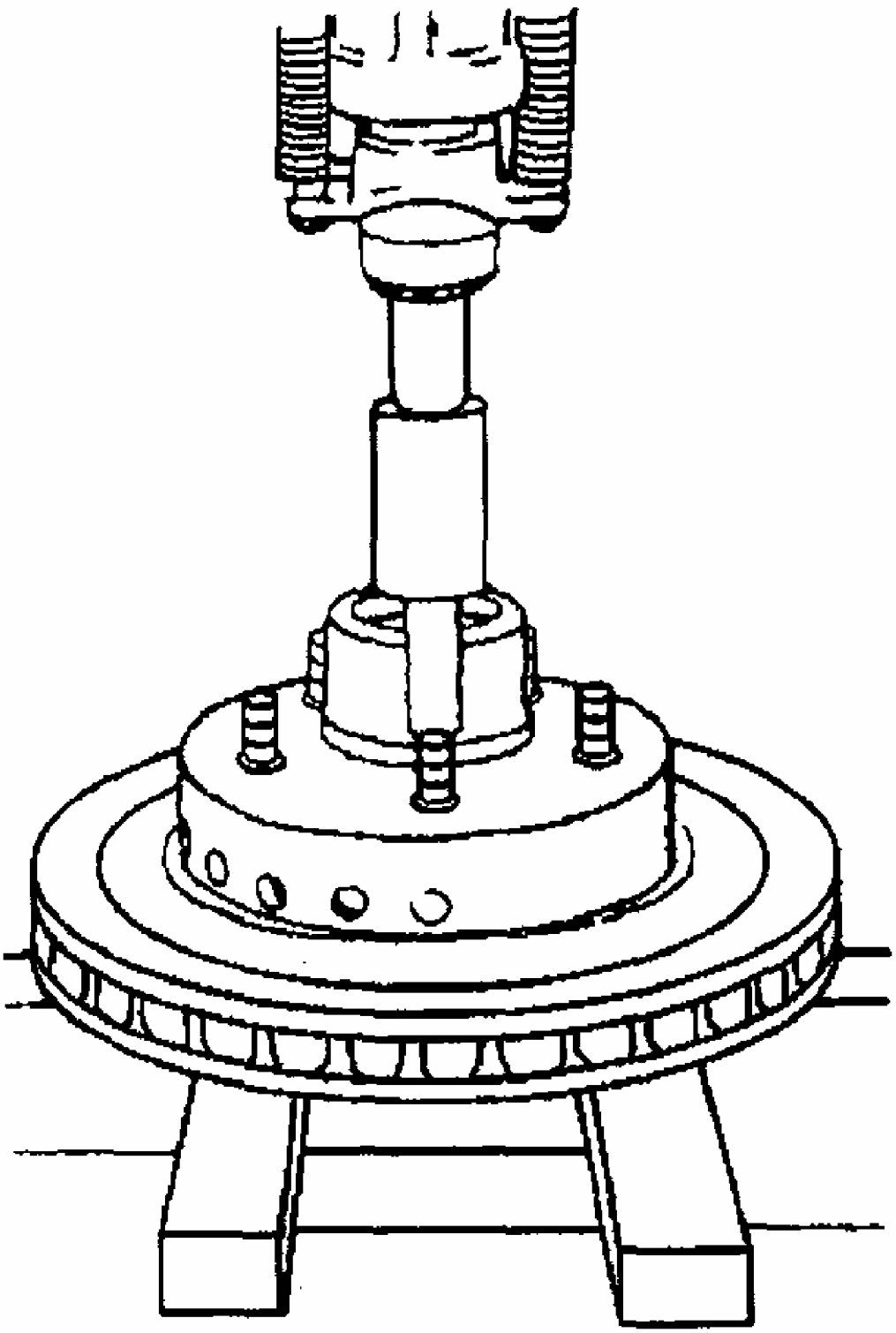
Fig. 97: Installing Lower Control Arm To Frame
Courtesy of GENERAL MOTORS CORP.

WHEEL STUD REPLACEMENT (RWD PICKUPS)

Removal Procedure

1. Remove the rotor. Refer to **WHEEL HUB, BEARING, AND SEAL REPLACEMENT (RWD PICKUP)** or **WHEEL HUB, BEARING, AND SEAL REPLACEMENT (4WD PICKUP AND UTILITIES)** .

2. Remove the wheel stud.
    - Press the stud out using an arbor press.
    - Do not damage the wheel mounting surface on the wheel hub flange.

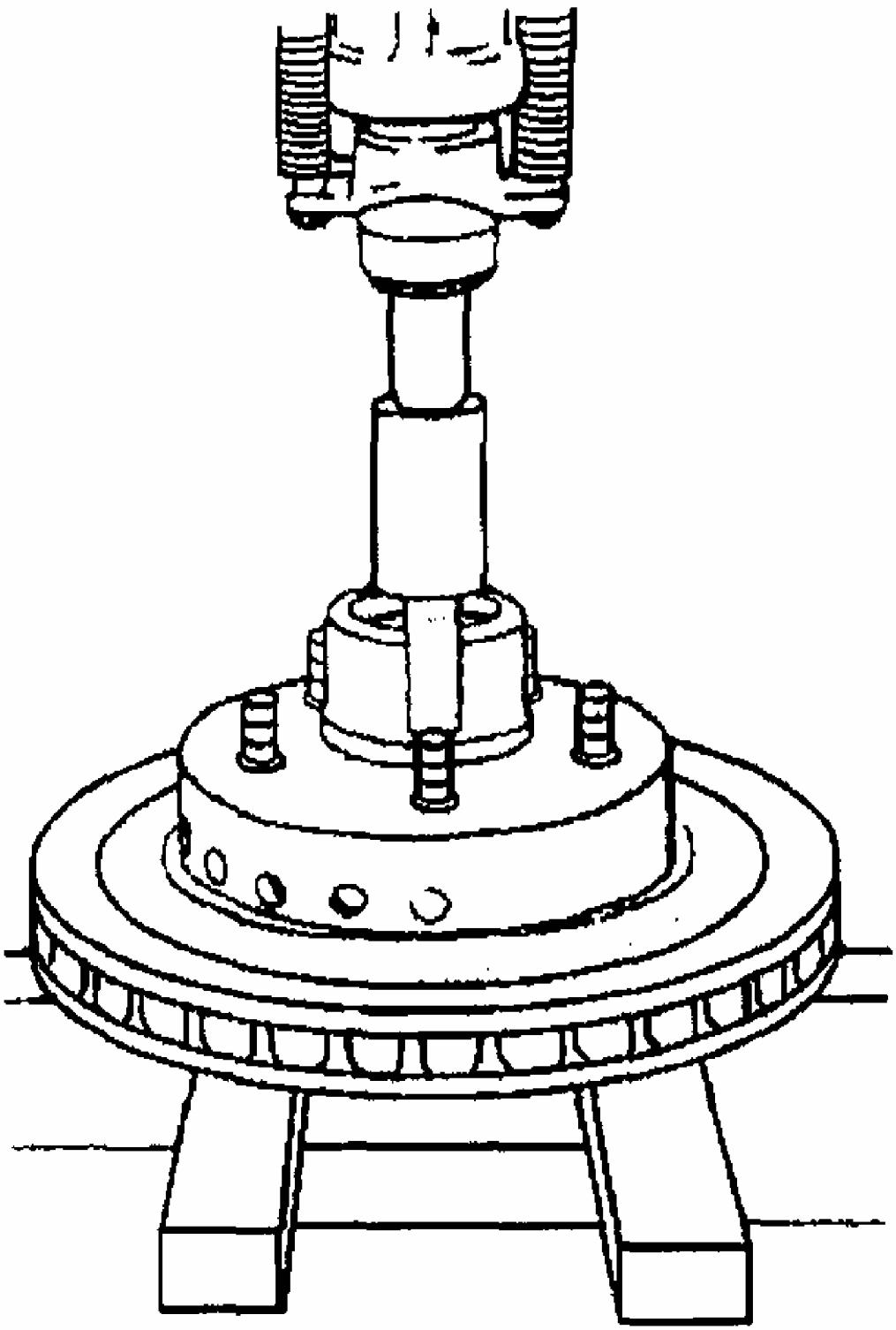


G01467716

Fig. 98: Wheel Stud
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the stud into the hole in the wheel hub.
   1.1 Start the serrated stud into the hole in the wheel hub by tapping lightly with a hammer.
   1.2 The stud must be square with the wheel hub before pressing on the arbor press.
2. Install the rotor. Refer to **WHEEL HUB, BEARING, AND SEAL REPLACEMENT (RWD PICKUP)** or **WHEEL HUB, BEARING, AND SEAL REPLACEMENT (4WD PICKUP AND UTILITIES)** .



G01467717

Fig. 99: Installing Stud Into Hole In Wheel Hub
Courtesy of GENERAL MOTORS CORP.

WHEEL STUD REPLACEMENT (4WD PICKUPS AND UTILITIES)

Tools Required

J 43631 Ball Joint Remover

Removal Procedure

1. Raise and suitably support the vehicle with safety stands. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the tire and the wheel. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
3. Remove the rotor. Refer to **BRAKE ROTOR -- FRONT** in Disc Brakes.

   Important: Do not hammer on a wheel stud.

4. Remove the wheel stud bolt using *J 43631* .

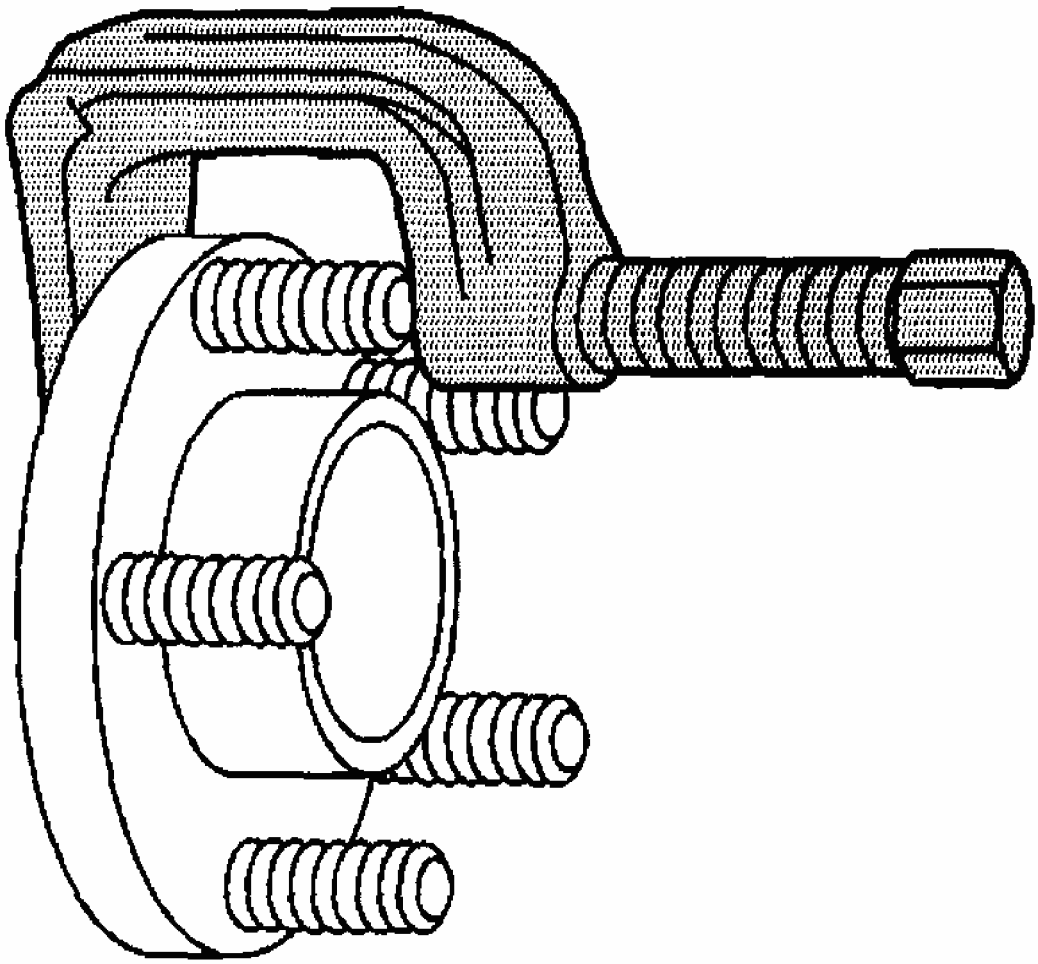


Fig. 100: Wheel Stud Bolt
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the wheel stud to the wheel hub and bearing.
2. Install 4 washers to the wheel stud.
3. Thread a wheel nut onto the new stud with the flat side facing the hub flange.
4. Tighten the wheel nut until the new stud contacts the back of the hub flange.
5. Remove the wheel nut and the washers.
6. Install the rotor. Refer to **BRAKE ROTOR -- FRONT** in Disc Brakes.
7. Install the tire and the wheel. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.

8. Lower the vehicle.

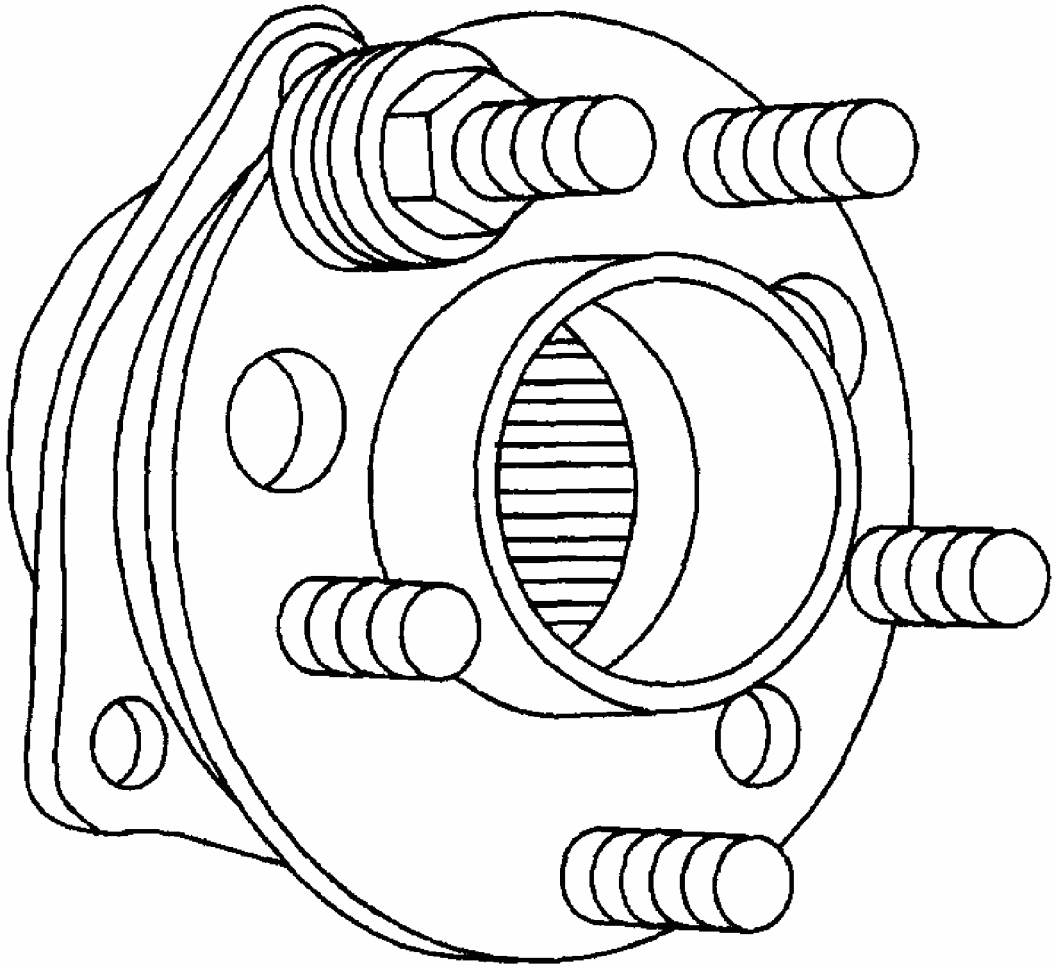


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Fig. 101: Installing Washers & Nut To Wheel Stud
Courtesy of GENERAL MOTORS CORP.

WHEEL HUB, BEARING, AND SEAL REPLACEMENT (RWD PICKUP)

Tools Required

J 29117-A Wheel Bearing Cup Remover

Removal Procedure

1. Raise and suitably support the vehicle with safety stands. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the tire and the wheel. Refer to **TIRE AND WHEEL REMOVAL AND**

INSTALLATION in Tires and Wheels.

3. Remove the brake caliper. Refer to **BRAKE CALIPER -- FRONT SINGLE PISTON** or **BRAKE CALIPER -- FRONT DUAL PISTON** in Disc Brakes.
4. Remove the dust cap from the rotor.
5. Remove the cotter pin, the nut, and the washer.

Important: Do not damage the outer bearing and the spindle threads.

6. Remove the wheel hub and bearing from the spindle.
7. Remove the outer bearing.
8. Remove the seal. Pry the seal out and discard the seal.
9. Remove the inner bearing.

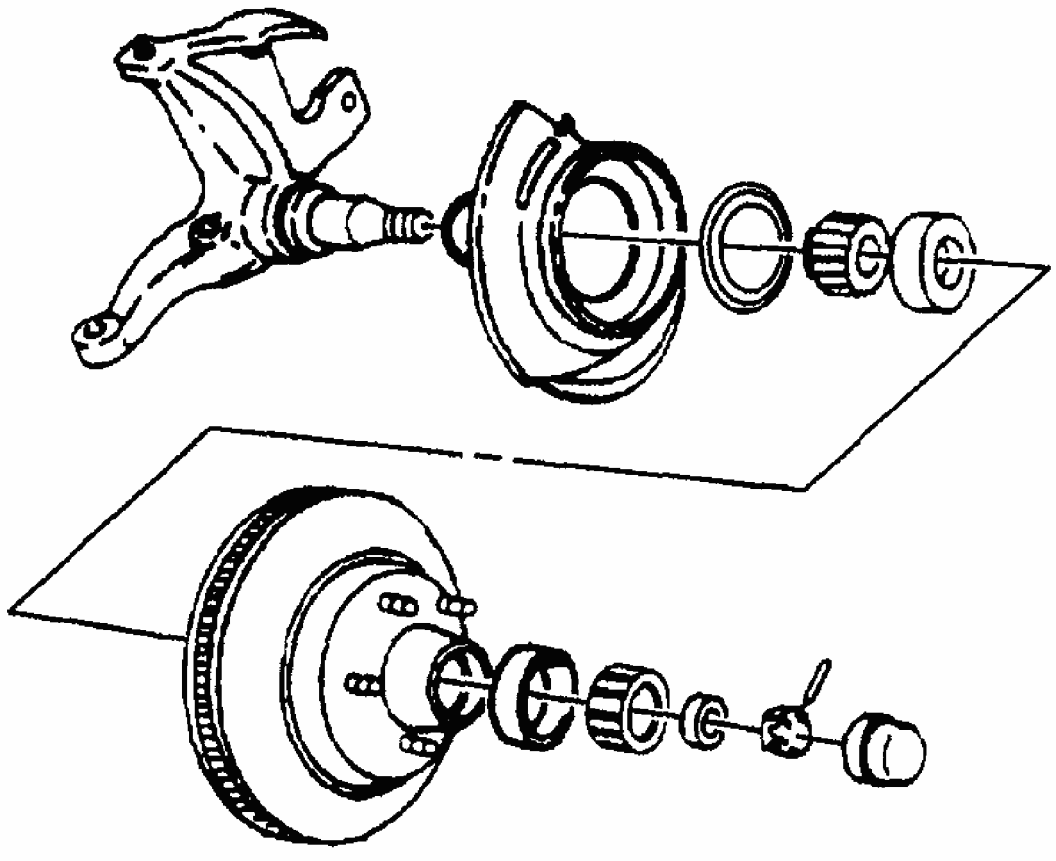

Fig. 102: Wheel Hub, Bearing & Seal
Courtesy of GENERAL MOTORS CORP.

10. Clean all of the parts in a solvent, then air dry. Do not spin the bearings with

compressed air.

11. Make sure all of the parts are clean and free of grease.
12. Inspect the rotor. Refer to BRAKE ROTOR SURFACE AND WEAR INSPECTION in Disc Brakes.
13. Inspect the bearings and the races for wear or damage. Refer to **WHEEL BEARING DIAGNOSIS (SEALED)** or **WHEEL BEARING DIAGNOSIS (TAPERED)** in Suspension General Diagnosis.
14. Remove the inner and outer races using *J29117-A* , if necessary.

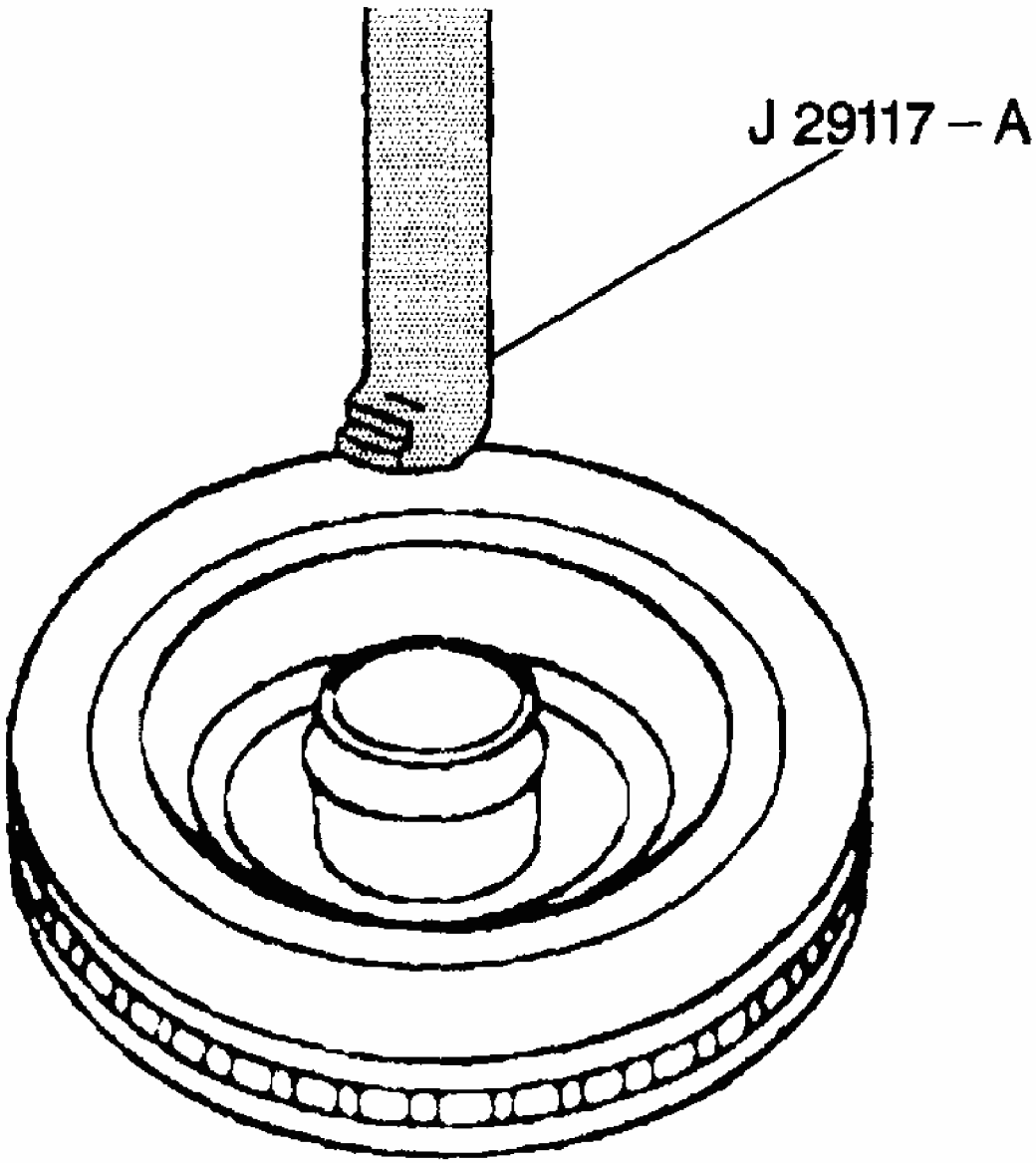

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Fig. 103: Inner & Outer Races
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

Important:

- Make sure that all of the parts are clean and free of grease.
- Apply an approved high-temperature front wheel bearing grease to the spindle at the inner and outer bearing seat, the shoulder, and the seal seat.
- Also, finger apply a small amount of grease inboard of each bearing cup in the rotor.
- Pressure pack the bearings with a grease machine or hand pack the bearings. Make sure the grease is worked thoroughly into the rollers, the cone, and the cage.

1. Install the inner and outer races, if necessary.
2. Install the inner bearing to the rotor.
3. Apply an additional quantity of grease outboard of the inner bearing.
4. Install the seal.
   - 4.1 Lubricate the seal lip.
   - 4.2 Use a flat plate in order to press the seal down flush with the wheel hub.
   - 4.3 Seat the outer wheel bearing and the cup.

   Important: Do not scuff the spindle threads.
5. Install the wheel and bearing to the spindle.
6. Install the outer bearing to the rotor.
7. Install the washer.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

8. Install the spindle nut.

   Tighten

   Tighten the spindle nut to 16 N.m (12 lb ft), while turning the wheel forward by hand.
9. Adjust the wheel bearings. Refer to **WHEEL BEARING ADJUSTMENT** .

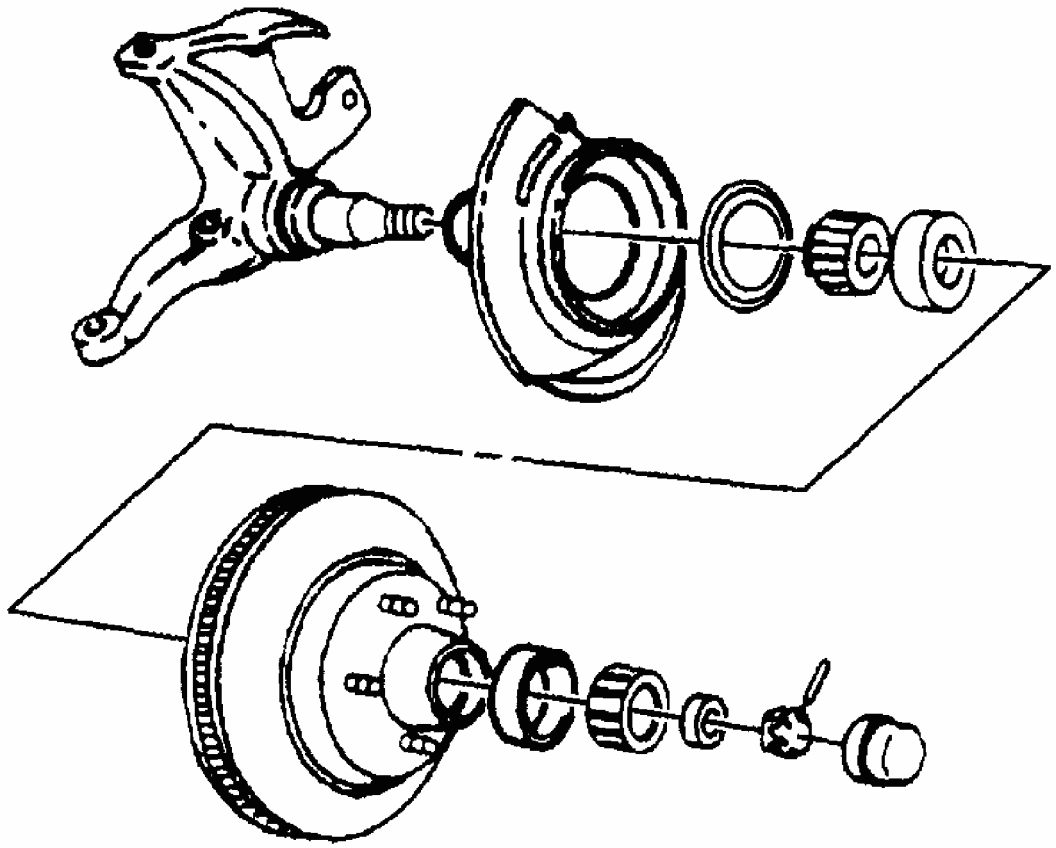

Fig. 104: Wheel Hub, Bearing & Seal
Courtesy of GENERAL MOTORS CORP.

10. Install new cotter pin. Bend the pin ends against the nut flats.
11. Install the dust cap to rotor.
12. Install the brake caliper. Refer to **BRAKE CALIPER -- FRONT SINGLE PISTON** or **BRAKE CALIPER -- FRONT DUAL PISTON** in Disc Brakes.
13. Install the tire and the wheel. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
14. Lower the vehicle.

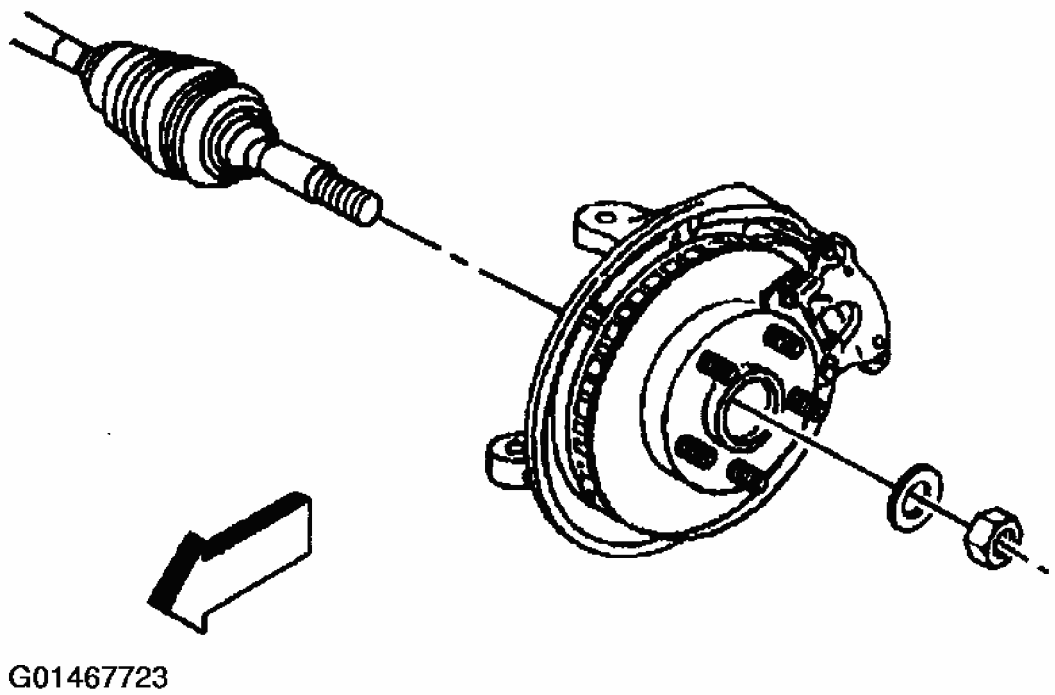

Fig. 105: Drive Axle Nut & Washer
Courtesy of GENERAL MOTORS CORP.

WHEEL HUB, BEARING, AND SEAL REPLACEMENT (4WD PICKUP AND UTILITIES)

Tools Required

J 45859 Axle Remover

Removal Procedure

1. Raise and support the vehicle with safety stands. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the tire and the wheel. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
3. Install punch in rotor vanes to hold from turning.
4. Remove the drive axle nut.
5. Remove the drive axle washer.
6. Remove the rotor. Refer to **BRAKE ROTOR -- FRONT** in Disc Brakes.
7. Using the *J 45859* or equivalent, disengage the wheel driveshaft from the hub and bearing.

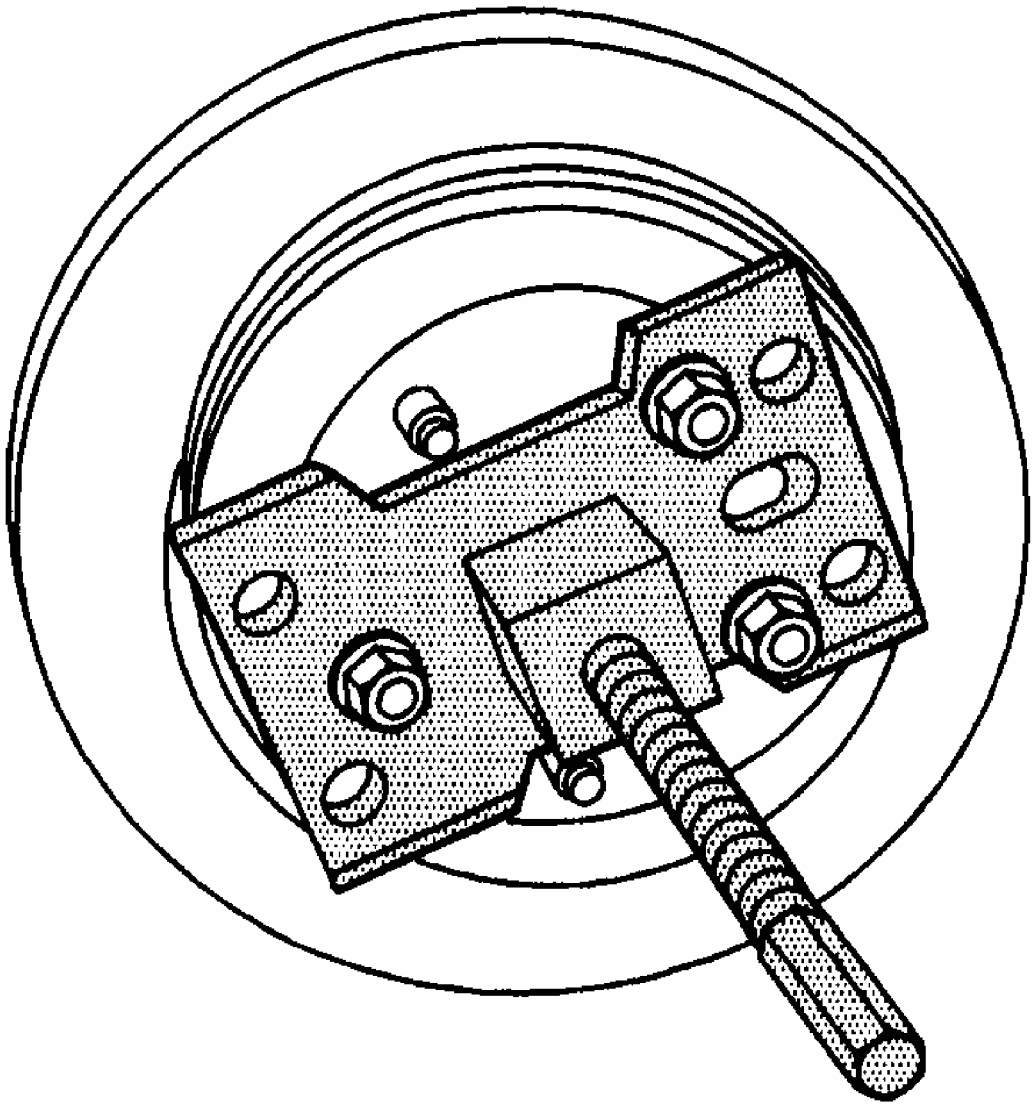

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Fig. 106: Disengaging Wheel Driveshaft From Hub & Bearing
Courtesy of GENERAL MOTORS CORP.

8. Remove the wheel speed sensor mounting bolt from the wheel hub and bearing.
9. Remove the wheel speed sensor from the wheel hub and bearing.

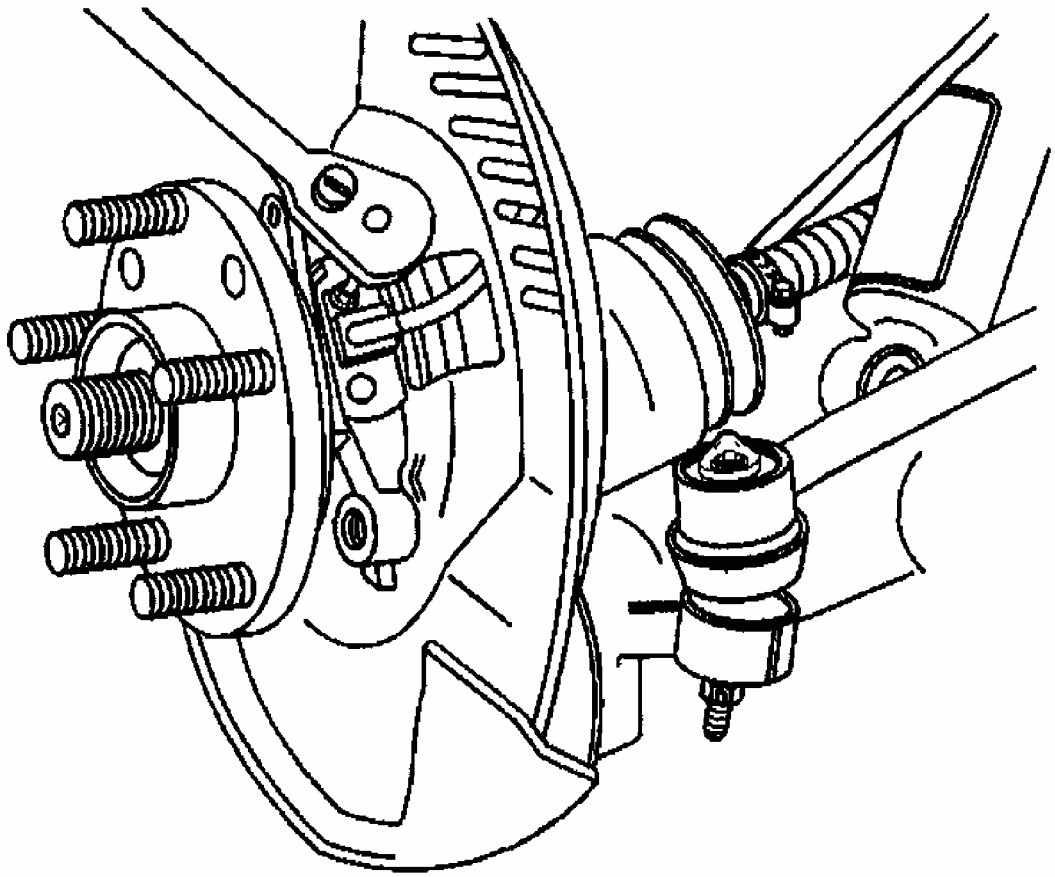

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Fig. 107: Removing Wheel Speed Sensor From Wheel Hub & Bearing
Courtesy of GENERAL MOTORS CORP.

10. Remove the wheel hub and bearing to the steering knuckle mounting bolts.

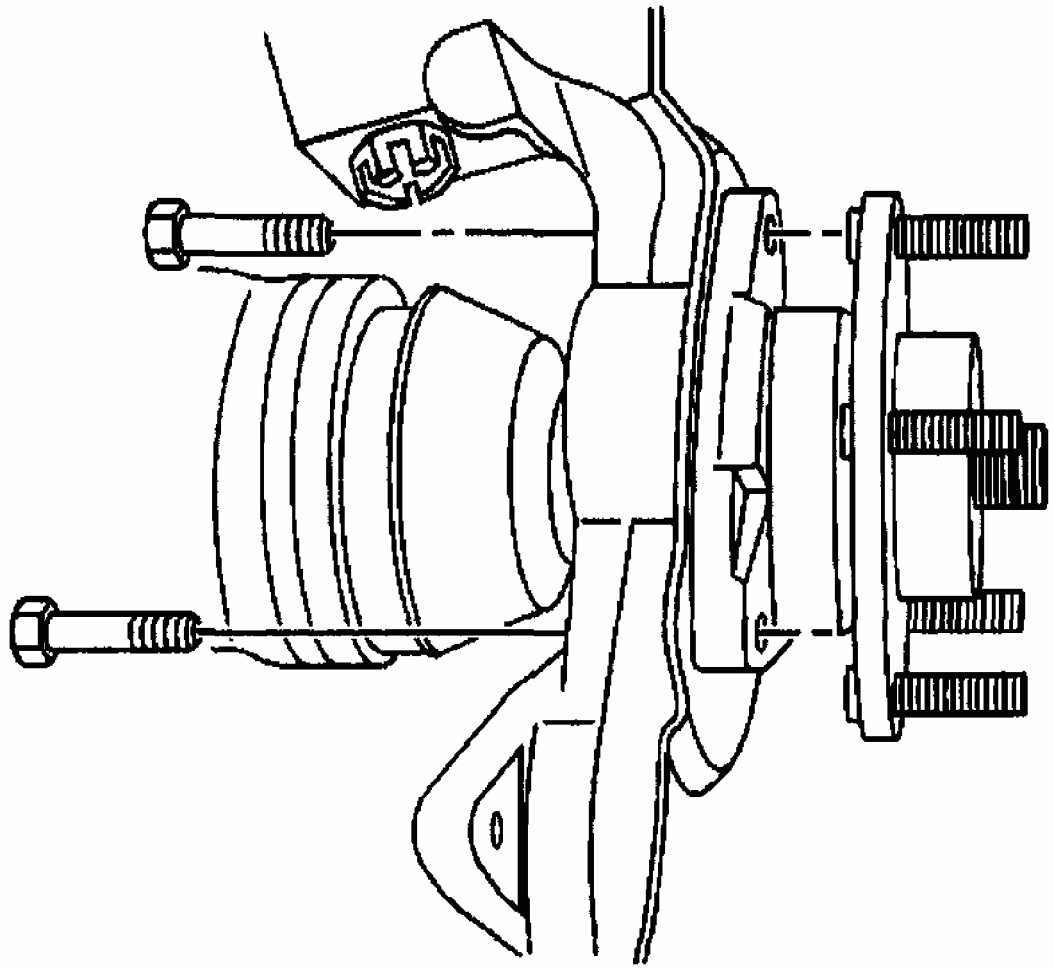

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Fig. 108: Removing Wheel Hub & Bearing To Steering Knuckle Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

Important: Lay the wheel hub and bearing on the wheel hub studs on the outboard side. This prevents damage or contamination to the bearing seal.

11. Remove the wheel hub and bearing to the steering knuckle.
12. Remove the splash shield from the steering knuckle.

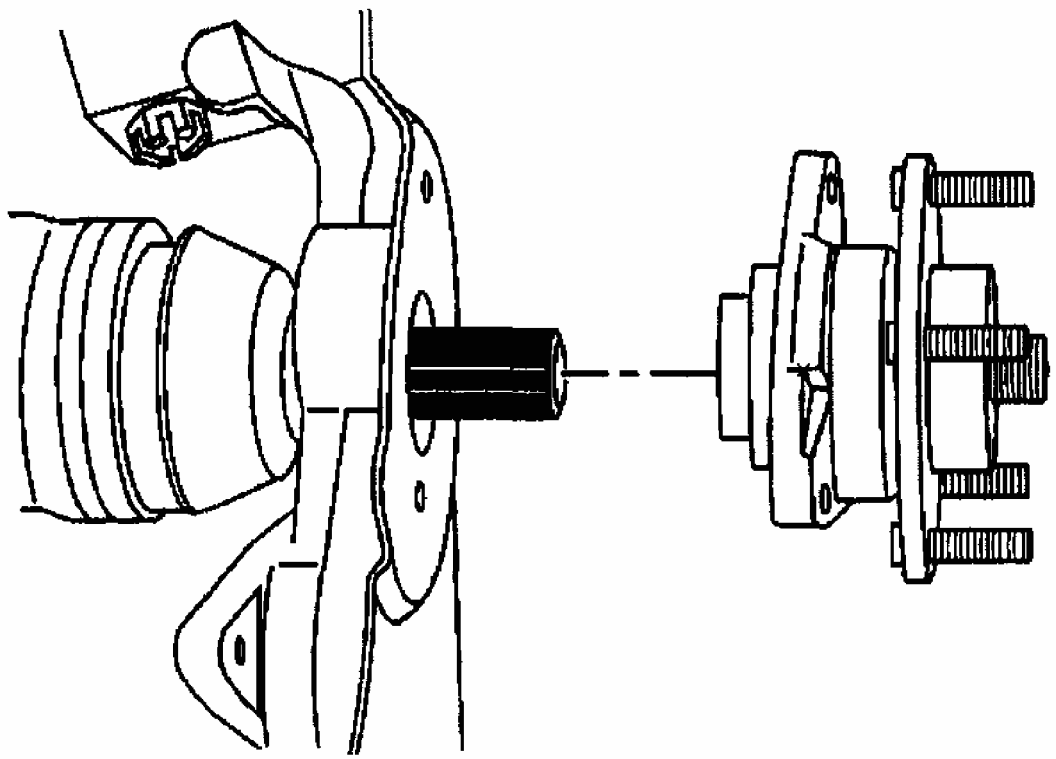

Fig. 109: Removing Wheel Hub & Bearing To Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

13. Remove the wheel hub and bearing seal from the wheel hub and bearing.

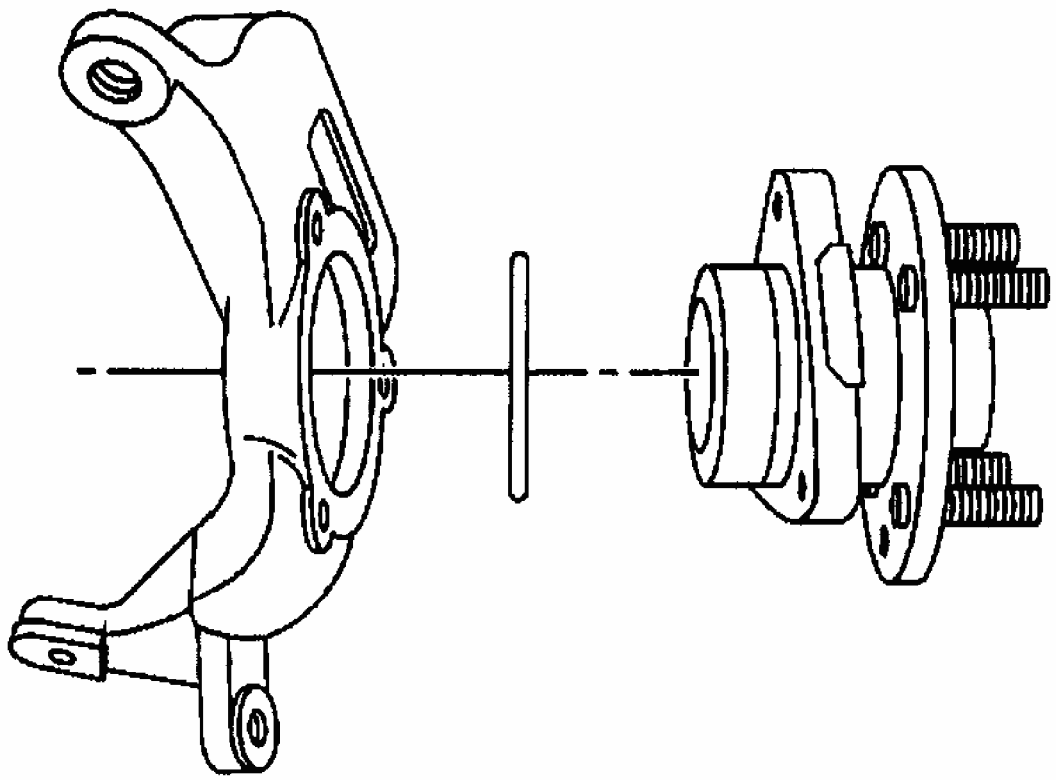

Fig. 110: Removing Wheel Hub & Bearing Seal From Wheel Hub & Bearing
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the wheel hub and bearing seal to the wheel hub and bearing.
2. Install the splash shield to the steering knuckle. Align the shield to the steering knuckle.

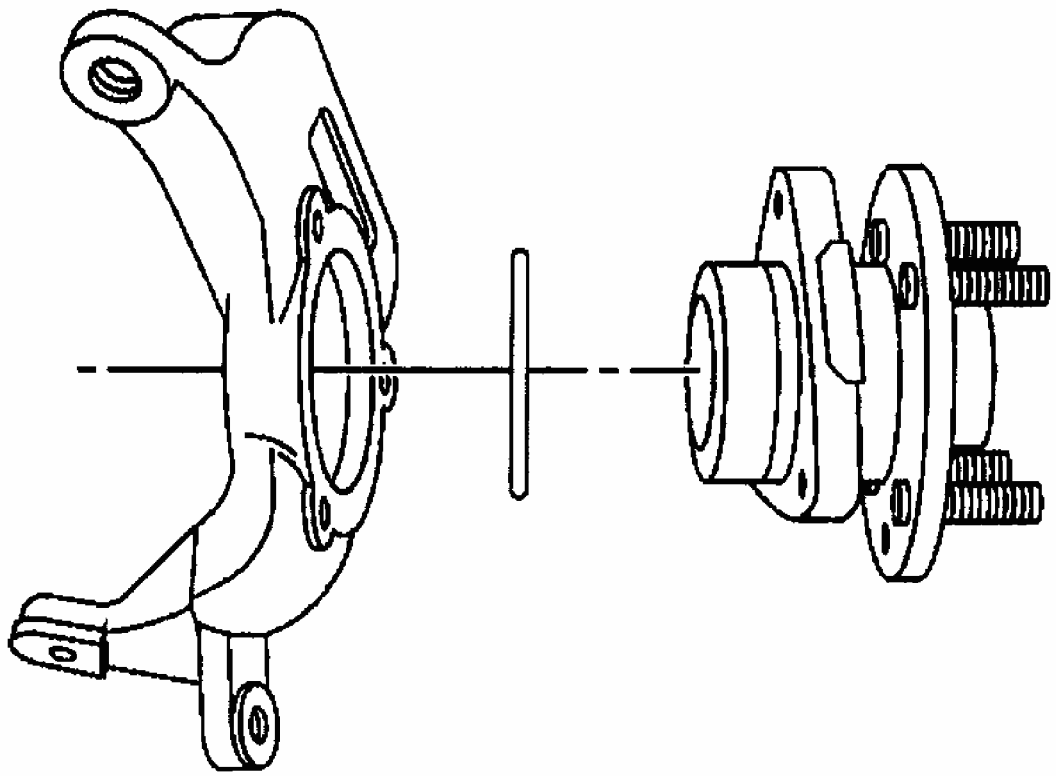

Fig. 111: Installing Wheel Hub & Bearing Seal To Wheel Hub & Bearing
Courtesy of GENERAL MOTORS CORP.

3. Install the wheel hub and bearing assembly to the steering knuckle. Align the threaded holes.

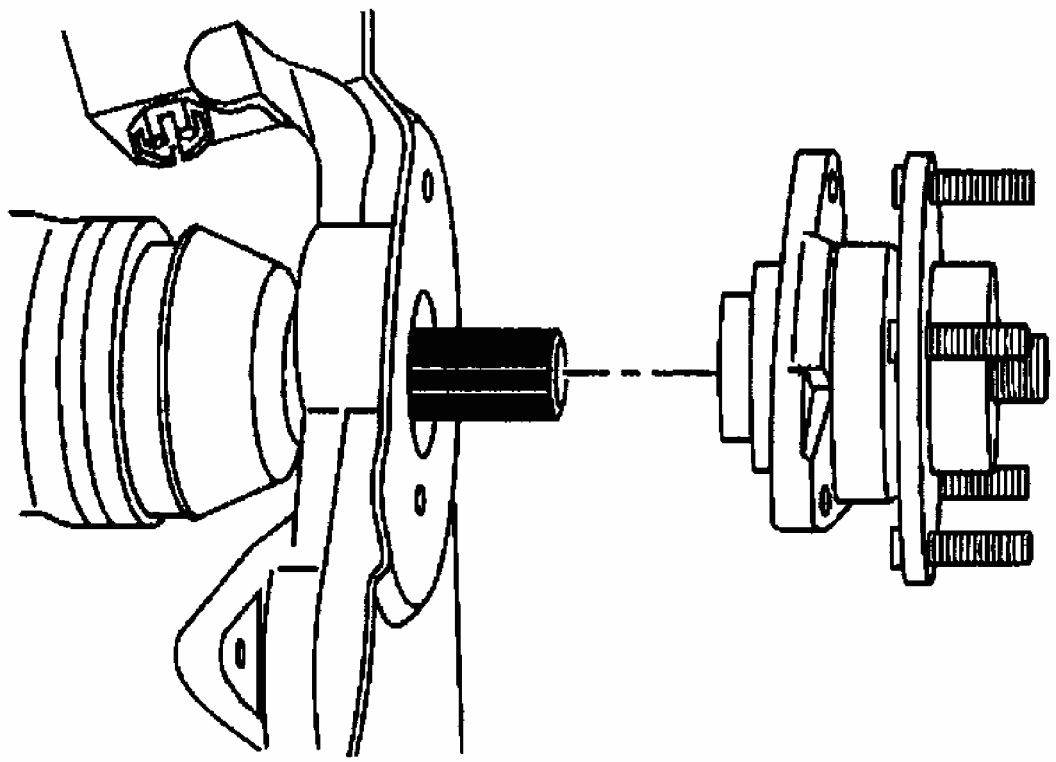

Fig. 112: Installing Wheel Hub & Bearing Assembly To Steering Knuckle
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

4. Install the wheel hub and bearing to the steering knuckle mounting bolts.

   Tighten

   Tighten the wheel hub and bearing to the steering knuckle mounting bolts to 105 N.m (77 lb ft).

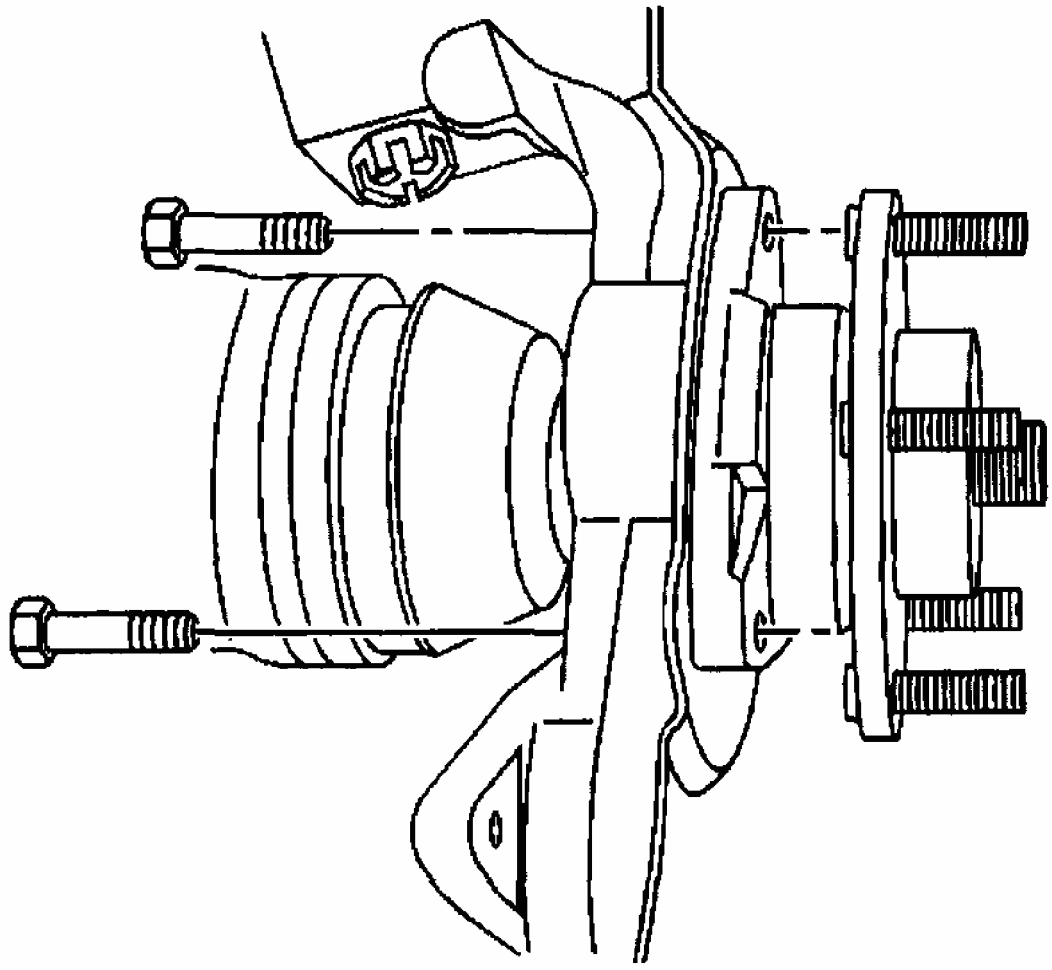

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Fig. 113: Installing Wheel Hub & Bearing To Steering Knuckle Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

5. Install the wheel speed sensor to the wheel hub and bearing.
6. Install the wheel speed sensor to the wheel hub and bearing mounting bolt.

Tighten

Tighten the wheel speed sensor to the wheel hub and bearing mounting bolt to 18 N.m (13 lb ft).

7. Install the rotor. Refer to **BRAKE ROTOR -- FRONT** in Disc Brakes.

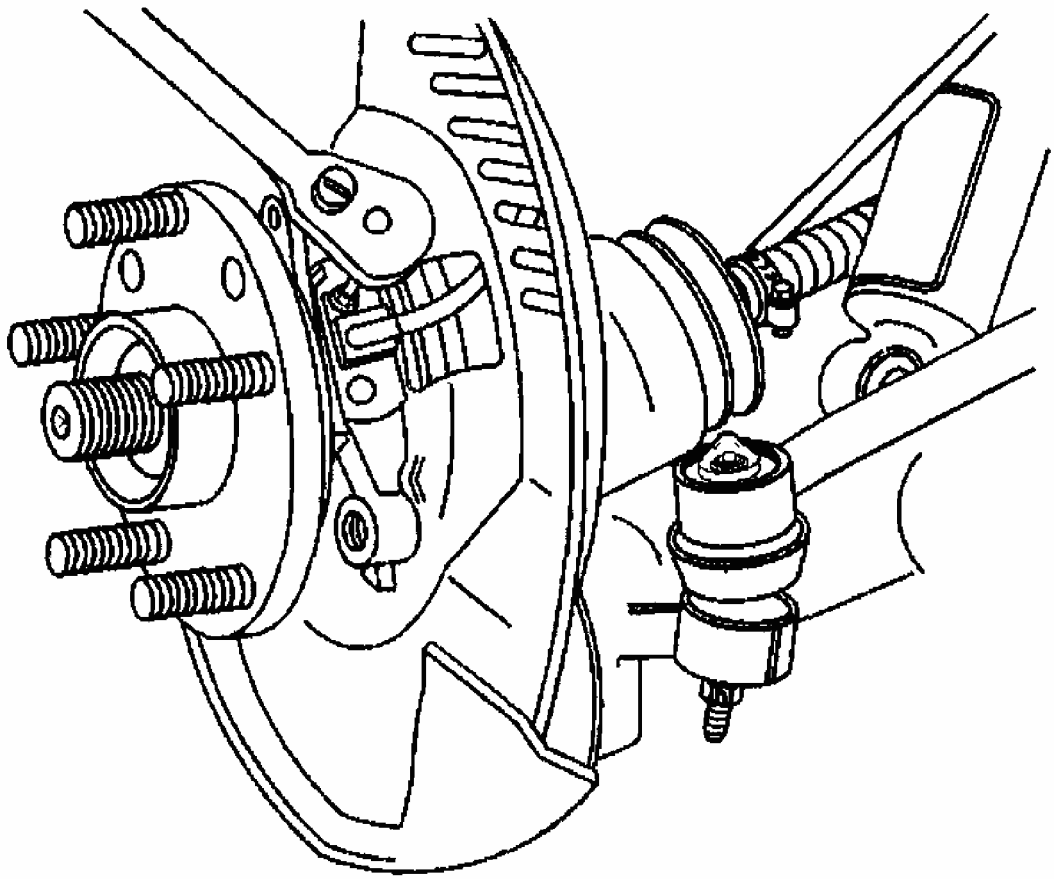

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Fig. 114: Installing Wheel Speed Sensor To Wheel Hub & Bearing
Courtesy of GENERAL MOTORS CORP.

8. Install punch in rotor vanes to hold from turning.
9. Install the drive axle washer.
10. Install the drive axle nut.

Tighten

Tighten the drive axle nut to 140 N.m (103 lb ft).

11. Install the tire and the wheel. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
12. Lower the vehicle.

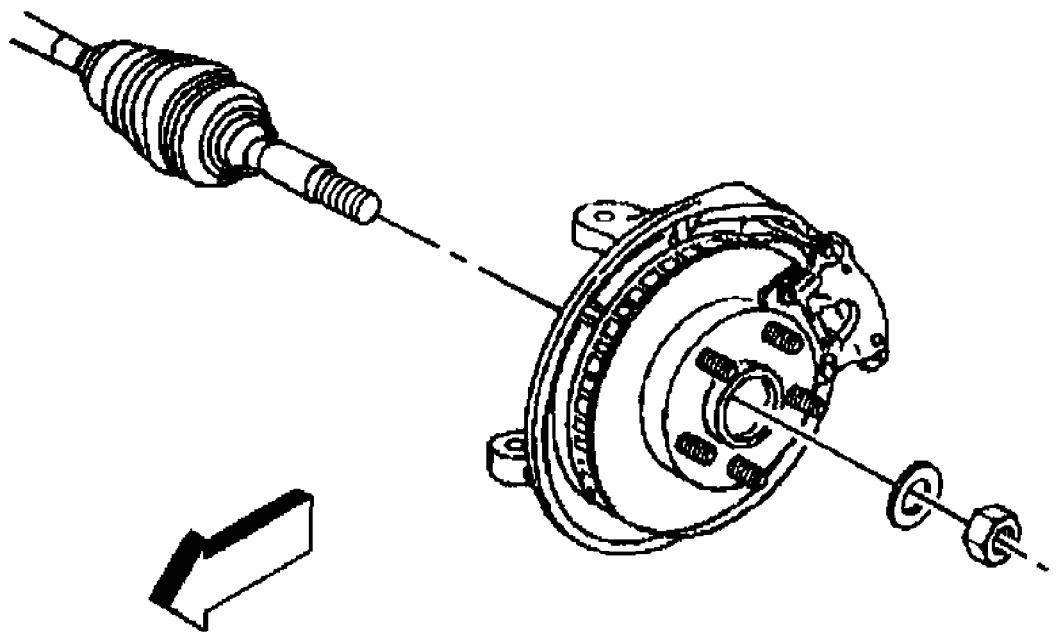

Fig. 115: Drive Axle Washer & Nut
Courtesy of GENERAL MOTORS CORP.

TORSION BAR AND SUPPORT ASSEMBLY REPLACEMENT

Tools Required

J 36202 Torsion Bar Loading/Unloading Tool

Removal Procedure

NOTE: Use care when handling the torsion bars in order to avoid chipping or scratching the coating. Damage to the coating will result in premature failure of the torsion bars.

1. Raise and support the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Mark the adjuster bolt.
3. Install *J 36202* to the adjustment arm and the crossmember.
4. Increase the tension on the adjustment arm until the load is removed from the adjuster bolt.

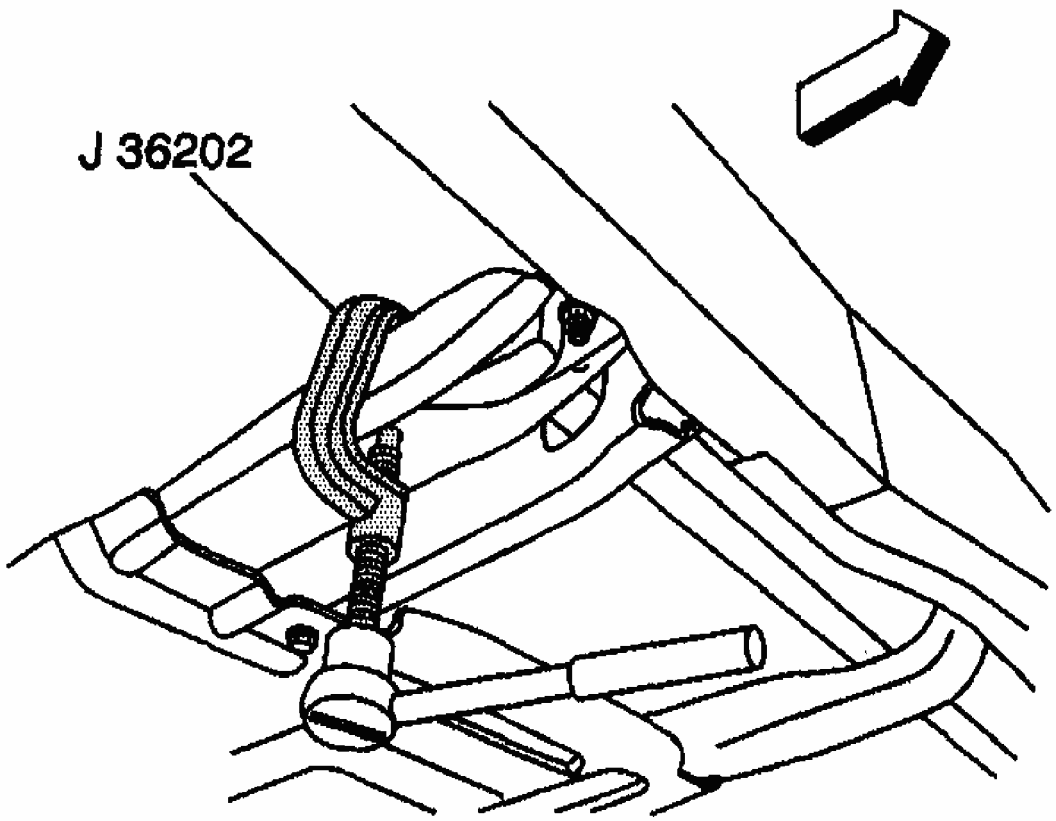

Fig. 116: Installing SST To Adjustment Arm & Crossmember
Courtesy of GENERAL MOTORS CORP.

Important: To aid in assembly, record the number of turns the tool makes when removing the adjuster bolt.

5. Remove the adjuster bolt and adjuster nut.
6. Remove *J 36202* from the adjustment arm, allowing the torsion bar to unload.
7. Remove the adjustment arm by sliding the torsion bar forward until the torsion bar clears the adjustment arm.
8. Remove the torsion bar support link upper mounting nuts.
9. Remove the torsion bar support link upper mounting bolts.
10. Remove the torsion bar support from the frame.

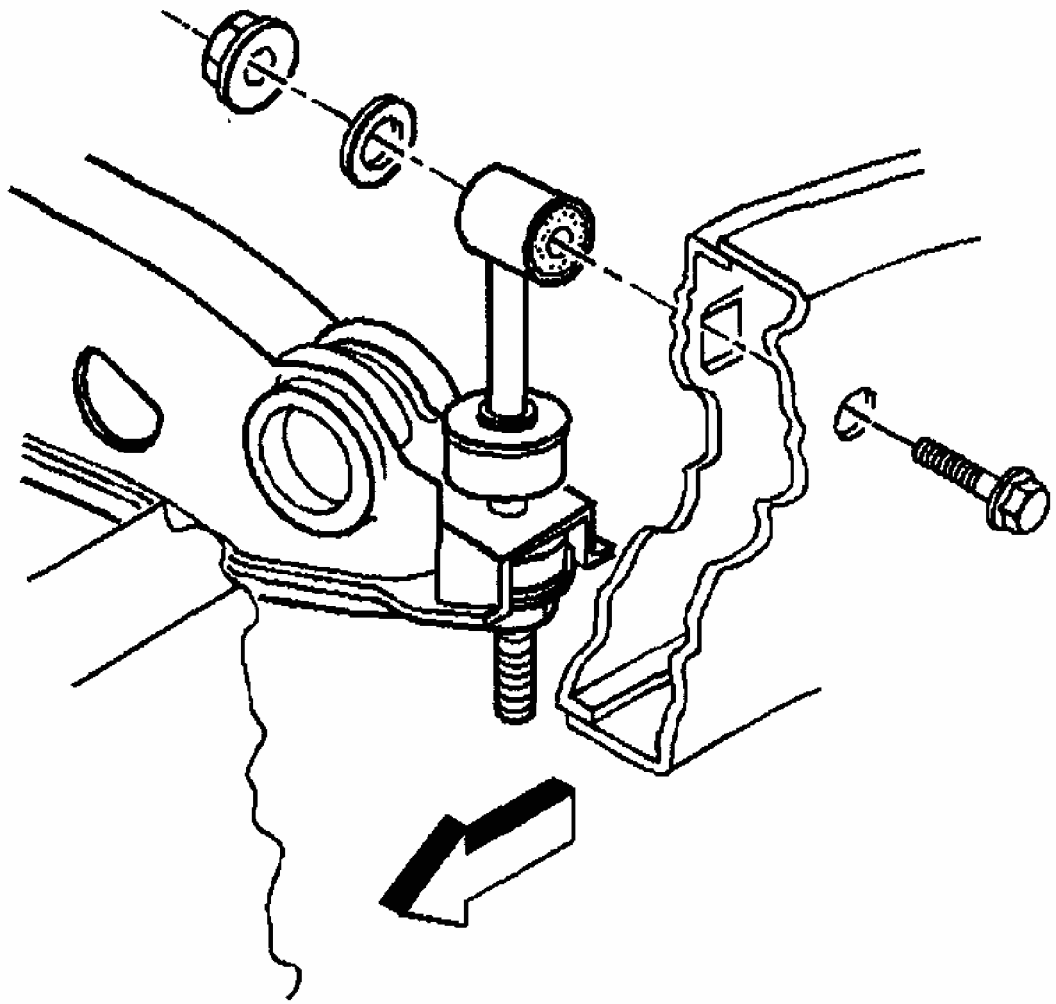

Fig. 117: Removing Torsion Bar Support From Frame
Courtesy of GENERAL MOTORS CORP.

11. Remove the torsion bars. Note the exact direction of the forward end and the side of the torsion bar that is being removed.

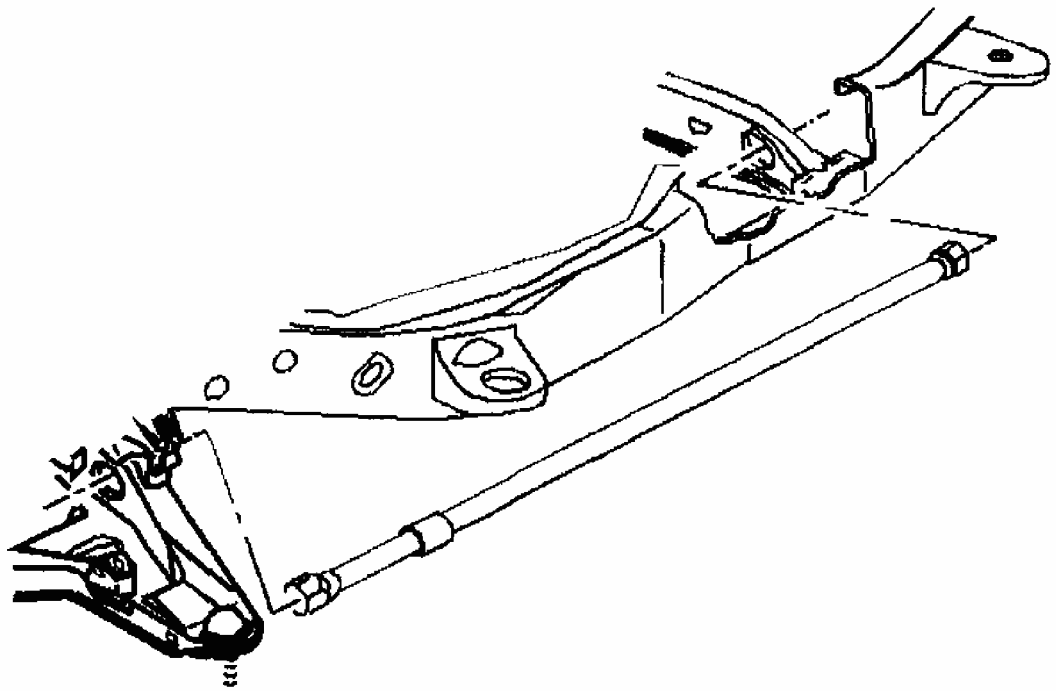

Fig. 118: Torsion Bars
Courtesy of GENERAL MOTORS CORP.

12. Remove the torsion bar links lower retaining nuts.
13. Remove the torsion bar links from the torsion bar support.

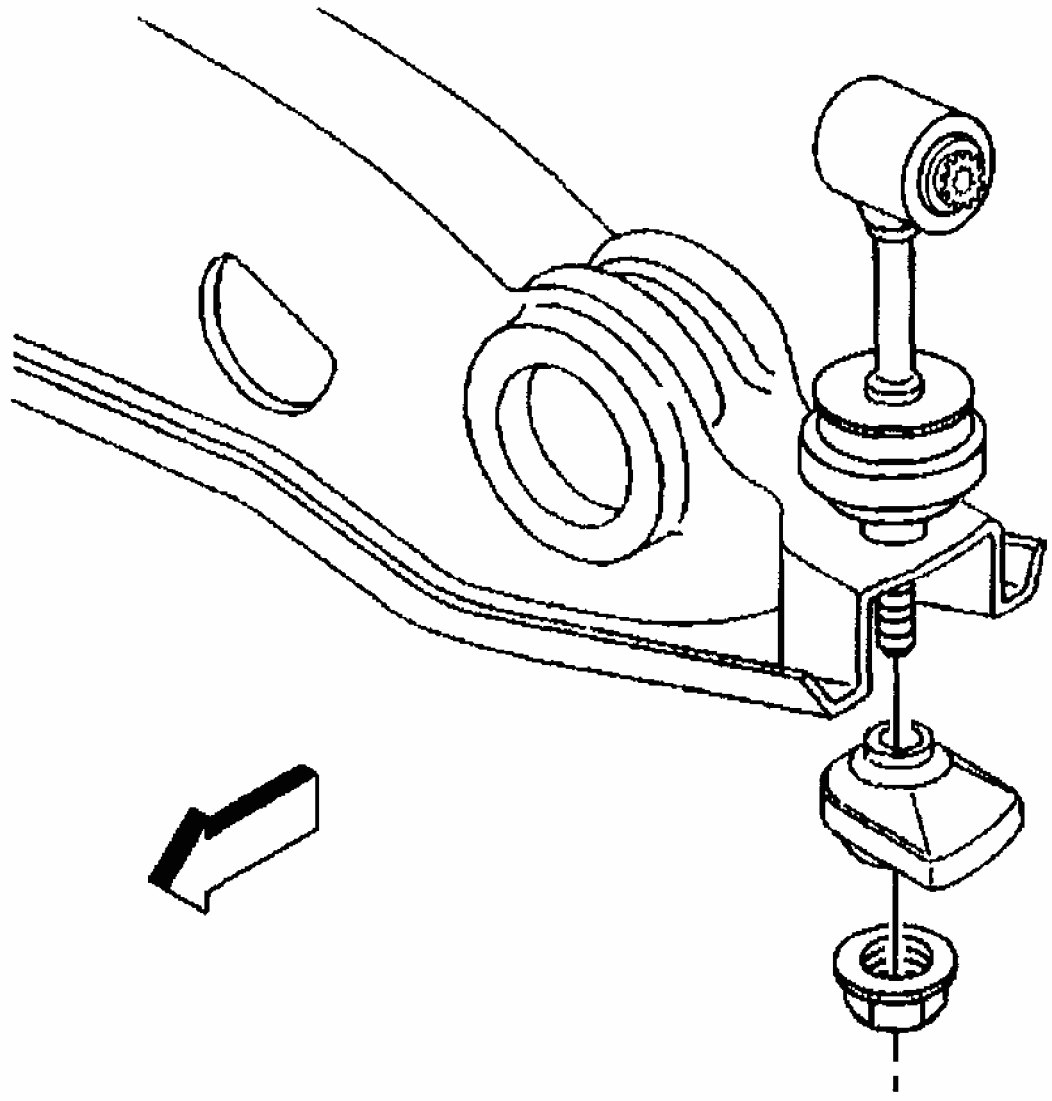

Fig. 119: Removing Torsion Bar Links From Torsion Bar Support
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the torsion bar links to the torsion bar support.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Install the torsion bar links lower retaining nuts.

Tighten

Tighten the torsion bar links lower retaining nuts to 50 N.m (37 lb ft).

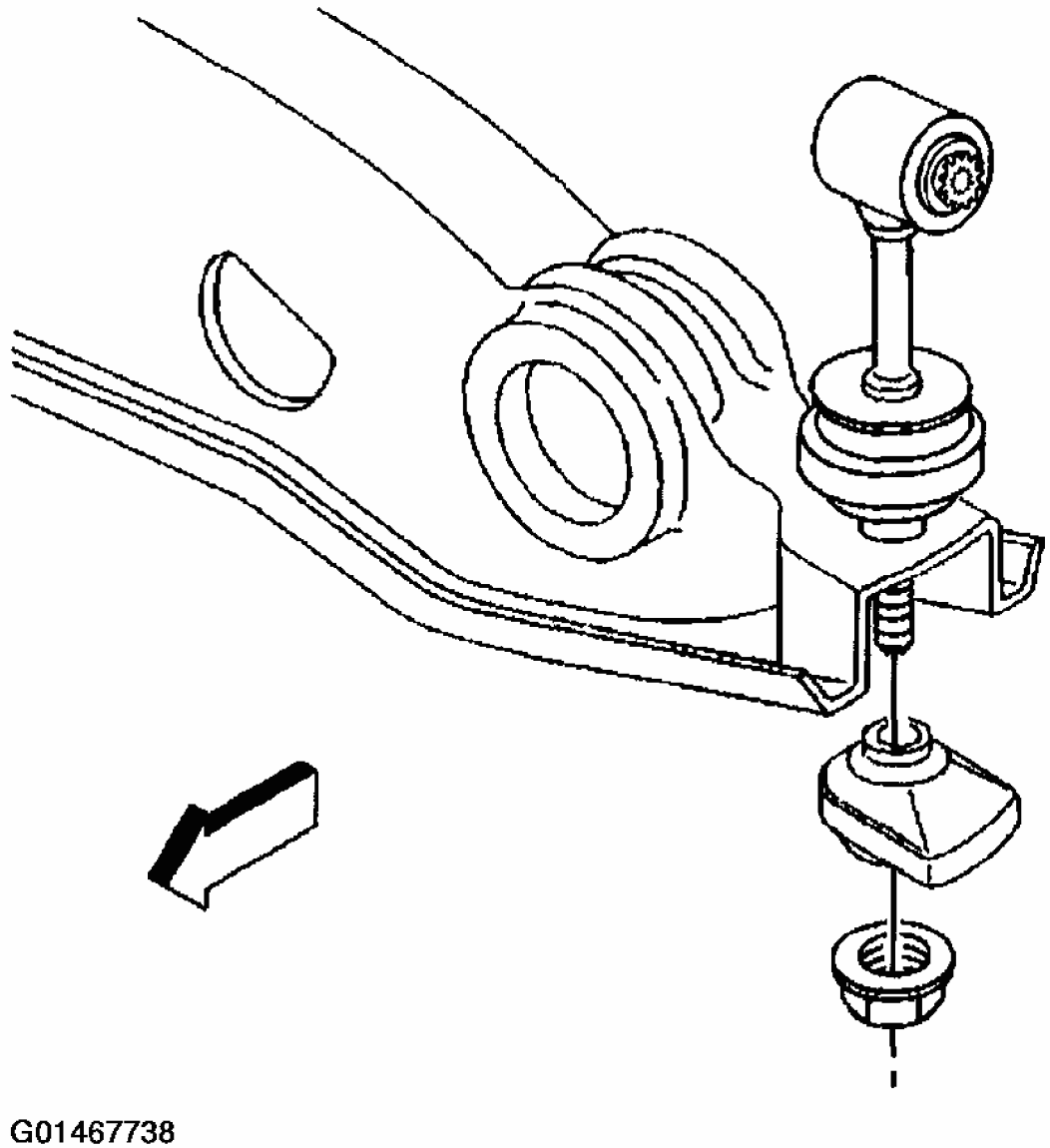

Fig. 120: Installing Torsion Bar Links To Torsion Bar Support
Courtesy of GENERAL MOTORS CORP.

3. Install the torsion bars in relation to where the bars were removed.
4. Install the torsion bar support to the frame.

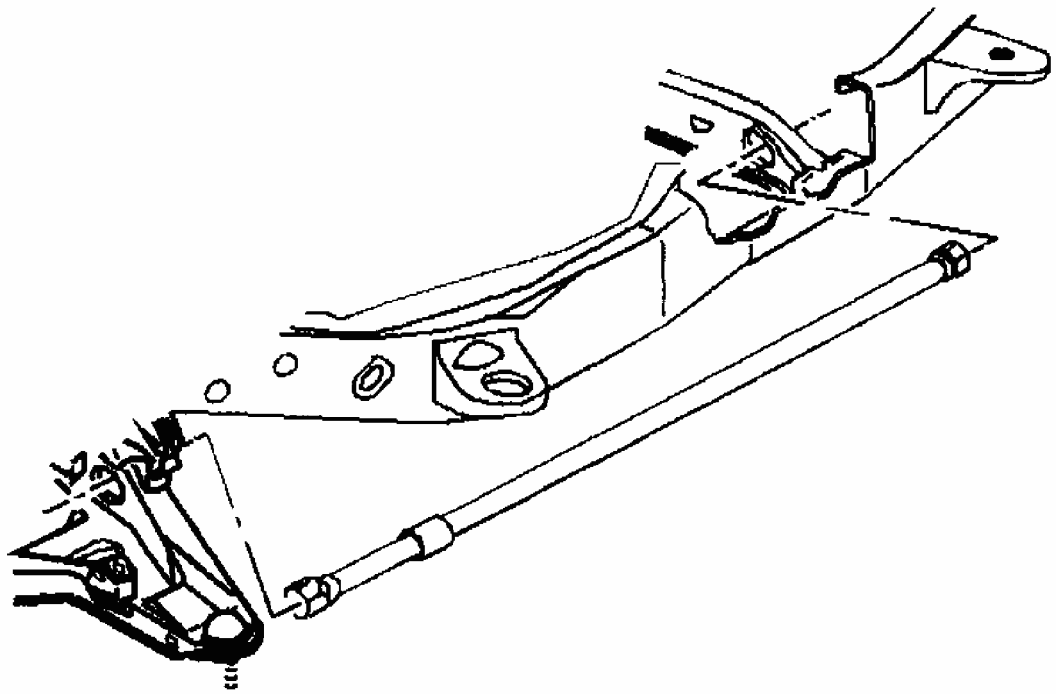

Fig. 121: Installing Torsion Bar Support To Frame
Courtesy of GENERAL MOTORS CORP.

5. Install the torsion bar support link upper mounting bolts to the frame.
6. Install the torsion bar support link upper mounting nuts.

Tighten

Tighten the torsion bar support link upper mounting nuts to 65 N.m (48 lb ft).

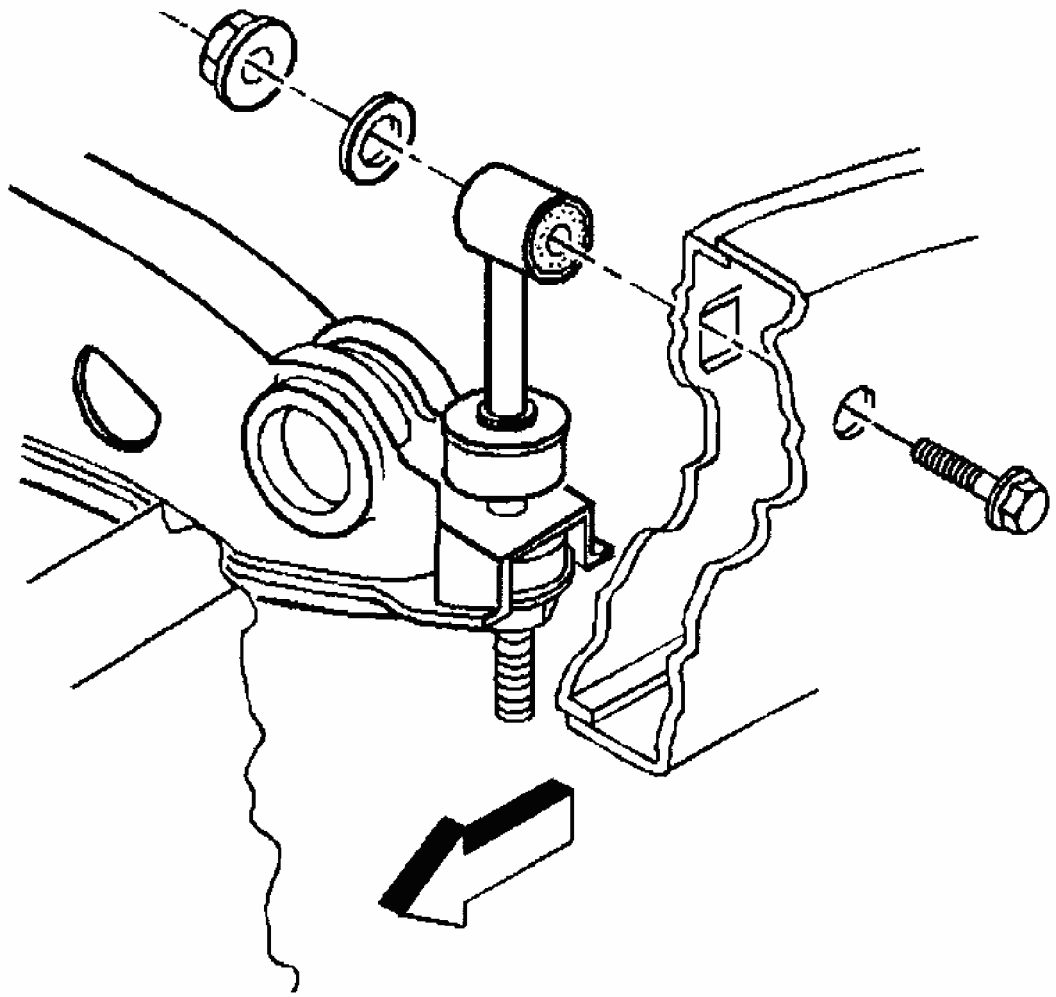

Fig. 122: Installing Torsion Bar Support Link Upper Mounting Bolts & Nuts To Frame
Courtesy of GENERAL MOTORS CORP.

7. Install the adjustment arm to the torsion bar support and slide the torsion bar rearward until the torsion bar fully engages the adjustment arm.
8. Install *J 36202* to the adjustment arm and the crossmember.
9. Increase the tension on the adjustment arm in order to load the torsion bar.

   Important: Tighten the adjuster bolt the same amount of turns that were required to remove the adjuster bolt during removal.

10. Install the adjuster bolt and adjuster nut
11. Remove *J 36202* from the adjustment arm and crossmember.

12. Lower the vehicle.
13. Check the wheel alignment. Refer to **WHEEL ALIGNMENT SPECIFICATIONS** in Wheel Alignment.

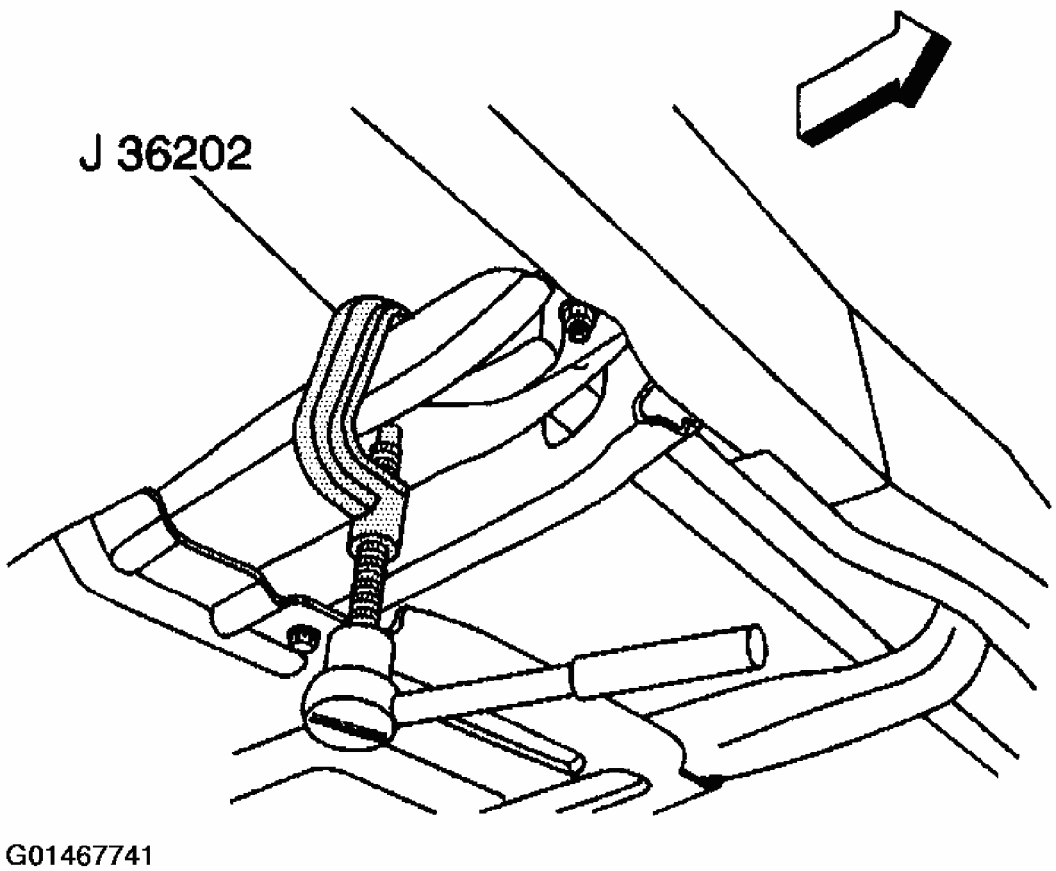

Fig. 123: Installing SST To Adjustment Arm & Crossmember
Courtesy of GENERAL MOTORS CORP.

SHOCK ABSORBER REPLACEMENT (RWD)

Removal Procedure

1. Raise and support the vehicle with safety stands. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the shock absorber upper mounting nut. Hold the shock absorber stem with a wrench while backing the nut off.
3. Remove the retainer.
4. Remove the grommet.
5. Remove the shock absorber lower mounting bolts.

5.1 Pull the shock absorber out of the spring from below.
5.2 The lower grommet and the retainer are on the stem.
5.3 Replace the parts as necessary.

6. Remove the nuts, if damaged or worn.

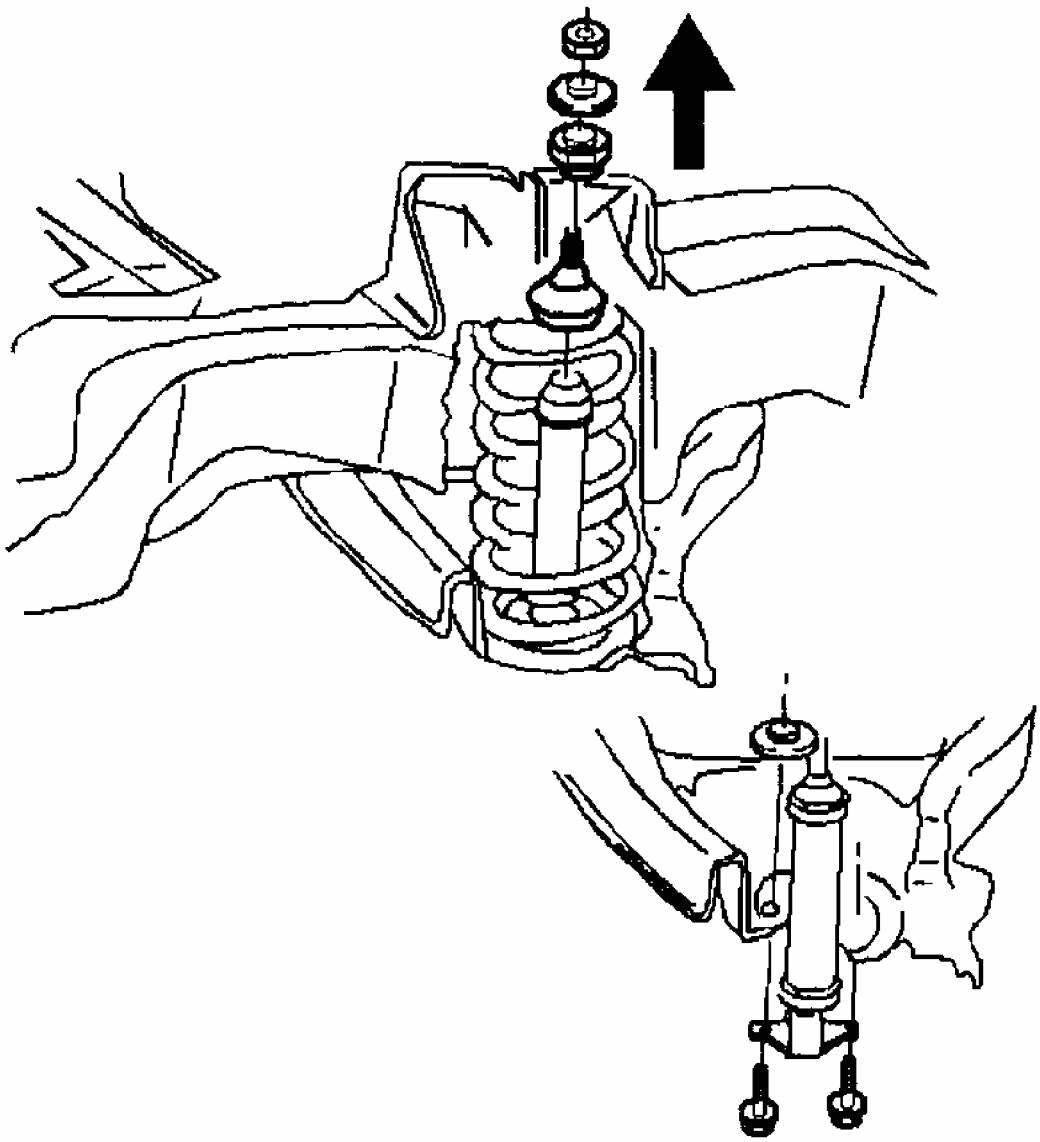

Fig. 124: Shock Absorber
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the retainer and the grommet on the stem. Fully extend the stem.
2. Install the shock absorber up through the lower control arm and the spring. Insert the stem end through the hole in the upper control arm frame bracket.
3. Install the grommet to the stem.
4. Install the retainer to the stem.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

5. Install the shock absorber upper nut.

   Tighten

   Tighten the shock absorber upper nut to 12 N.m (106 lb in), while holding the stem with a wrench.

6. Install new nuts, if needed.
7. Install the shock absorber lower bolts through the pivot holes to the lower control arm holes.

   Tighten

   Tighten the shock absorber lower bolts to 30 N.m (22 lb ft).

8. Lower the vehicle.

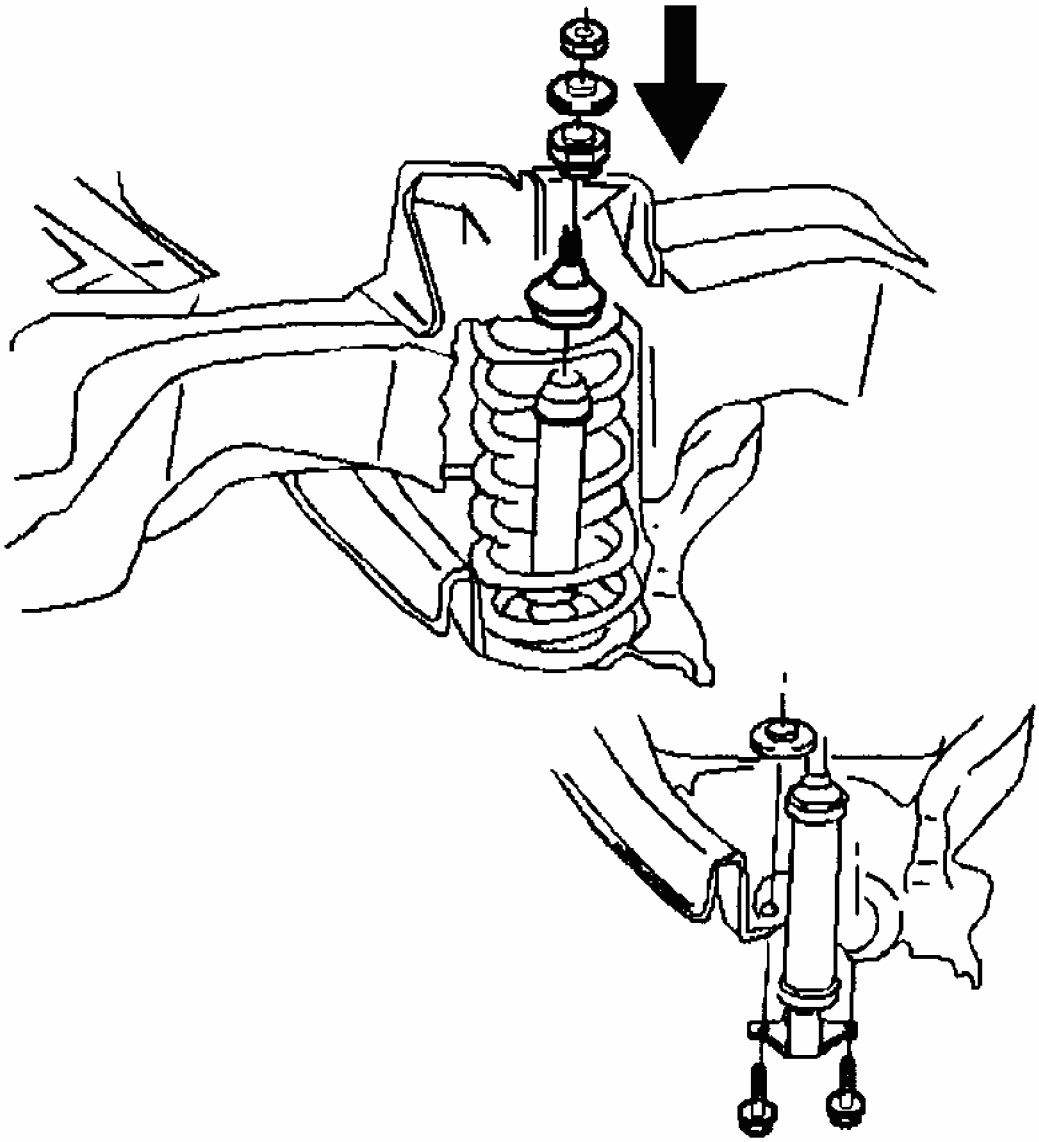

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Fig. 125: Shock Absorber
Courtesy of GENERAL MOTORS CORP.

SHOCK ABSORBER REPLACEMENT (4WD)

Removal Procedure

1. Raise and support the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the tire and wheel. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.

3. Remove the shock absorber lower mounting nut and bolt.
4. Remove the shock absorber upper mounting nut and bolt.
5. Remove the shock absorber.

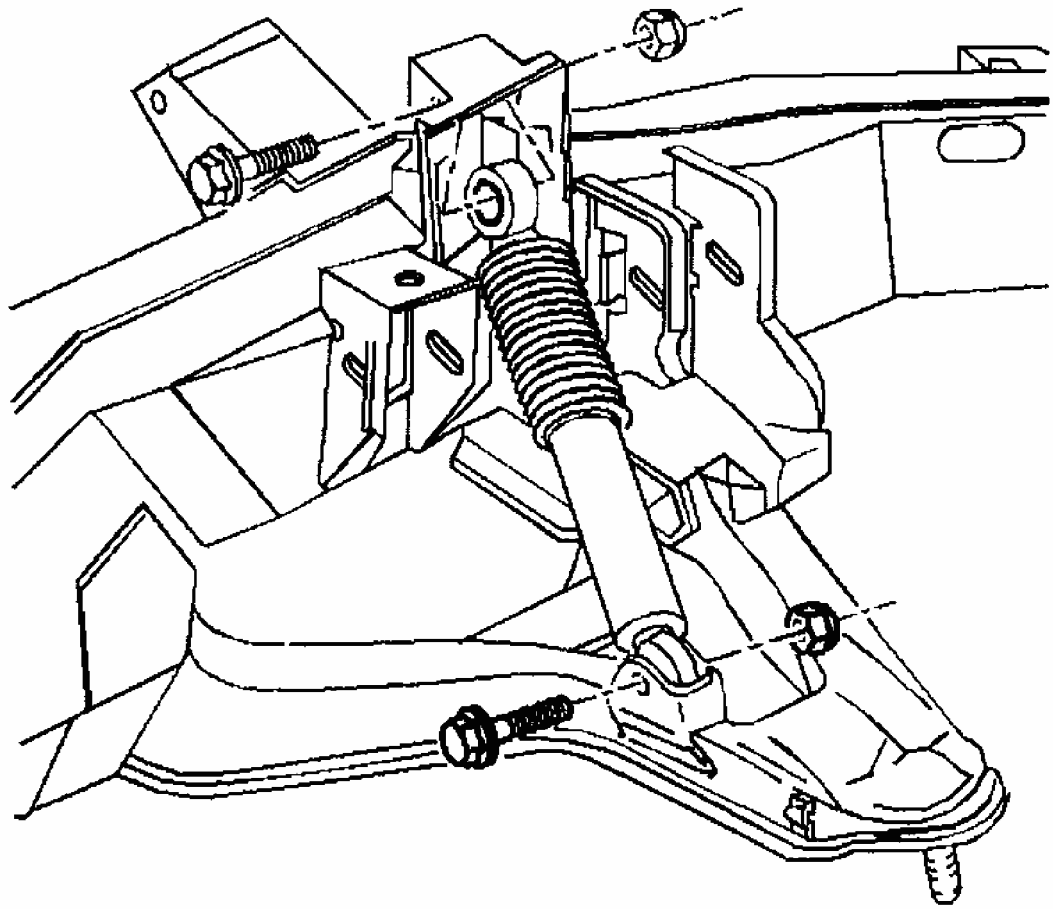

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Fig. 126: Shock Absorber
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the shock absorber to the bracket.
2. Install the upper and lower shock absorber bolts. Fit the bolts in the direction shown.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

3. Install the upper and lower shock absorber nuts.

Tighten

- Tighten the shock absorber mounting nuts and the bolts with the front suspension loaded.
- Tighten the shock absorber upper and lower mounting nuts to 73 N.m (54 lb ft).

4. Install the tire and wheel. Refer to **TIRE AND WHEEL REMOVAL AND INSTALLATION** in Tires and Wheels.
5. Lower the vehicle.

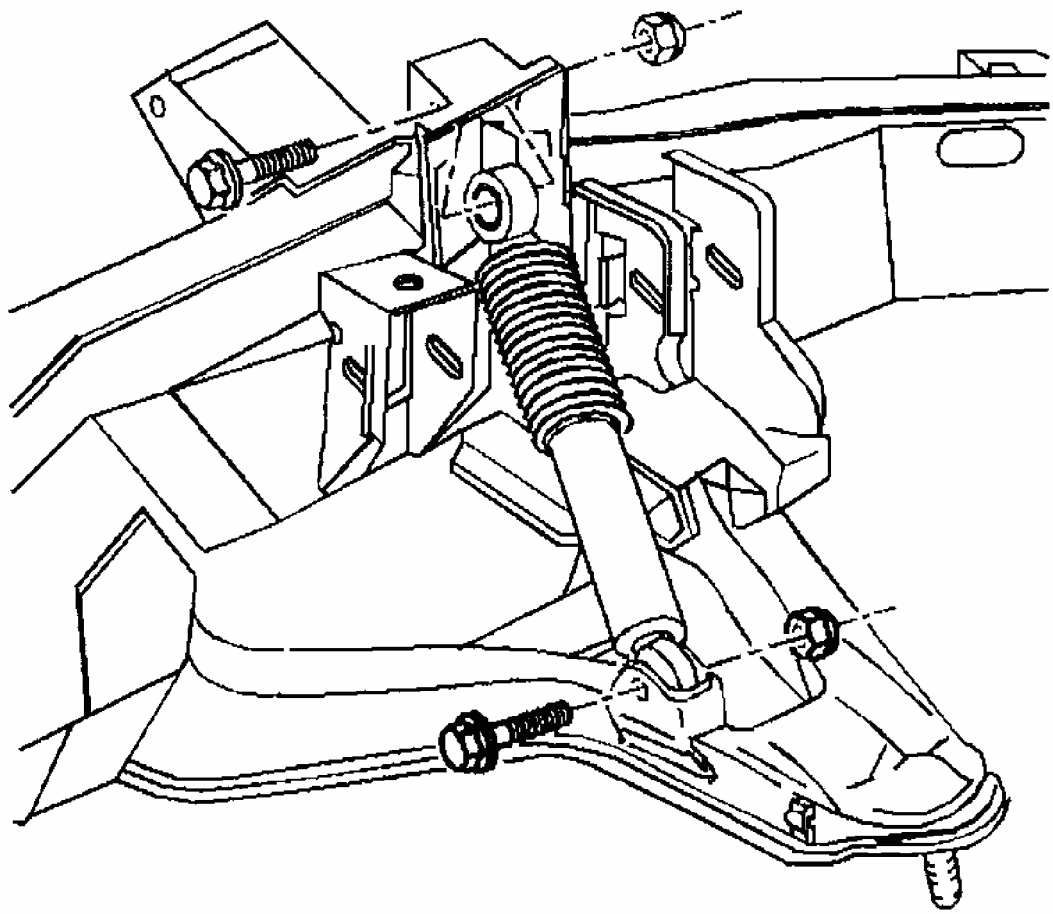

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Fig. 127: Shock Absorber
Courtesy of GENERAL MOTORS CORP.

SHOCK ABSORBER DISPOSAL

CAUTION: Gas charged shock absorbers contain high pressure gas. Do not remove the snap ring from inside the top of the tube.

If the snap ring is removed, the contents of the shock absorber will come out with extreme force which may result in personal injury.

CAUTION: To prevent personal injury, wear safety glasses when centerpunching and drilling the shock absorber. Use care not to puncture the shock absorber tube with the centerpunch.

1. Make an indentation 10 mm (0.4 in) from the bottom (4) of the tube (3) using a centerpunch.
2. Clamp the shock absorber in a vise horizontally with the shock absorber rod (1) completely extended.
3. Drill a hole in the shock absorber at the centerpunch (4) using a 5 mm (3/16 in) drill bit. Gas or a gas/oil mixture will exhaust when the drill bit penetrates the shock absorber. Use shop towels in order to contain the escaping oil.
4. Make an indentation in the middle (2) of the tube (3) with a centerpunch.
5. Drill a second hole in the shock absorber at the centerpunch (2) using a 5 mm (3/16 in) drill bit. Oil will exhaust when the drill bit penetrates the shock absorber. Use shop towels in order to contain the escaping oil.
6. Remove the shock absorber from the vise. Hold the shock absorber over a drain pan horizontally with the holes down. Move the rod (1) in and out of the tube (3) to completely drain the oil from the shock absorber.

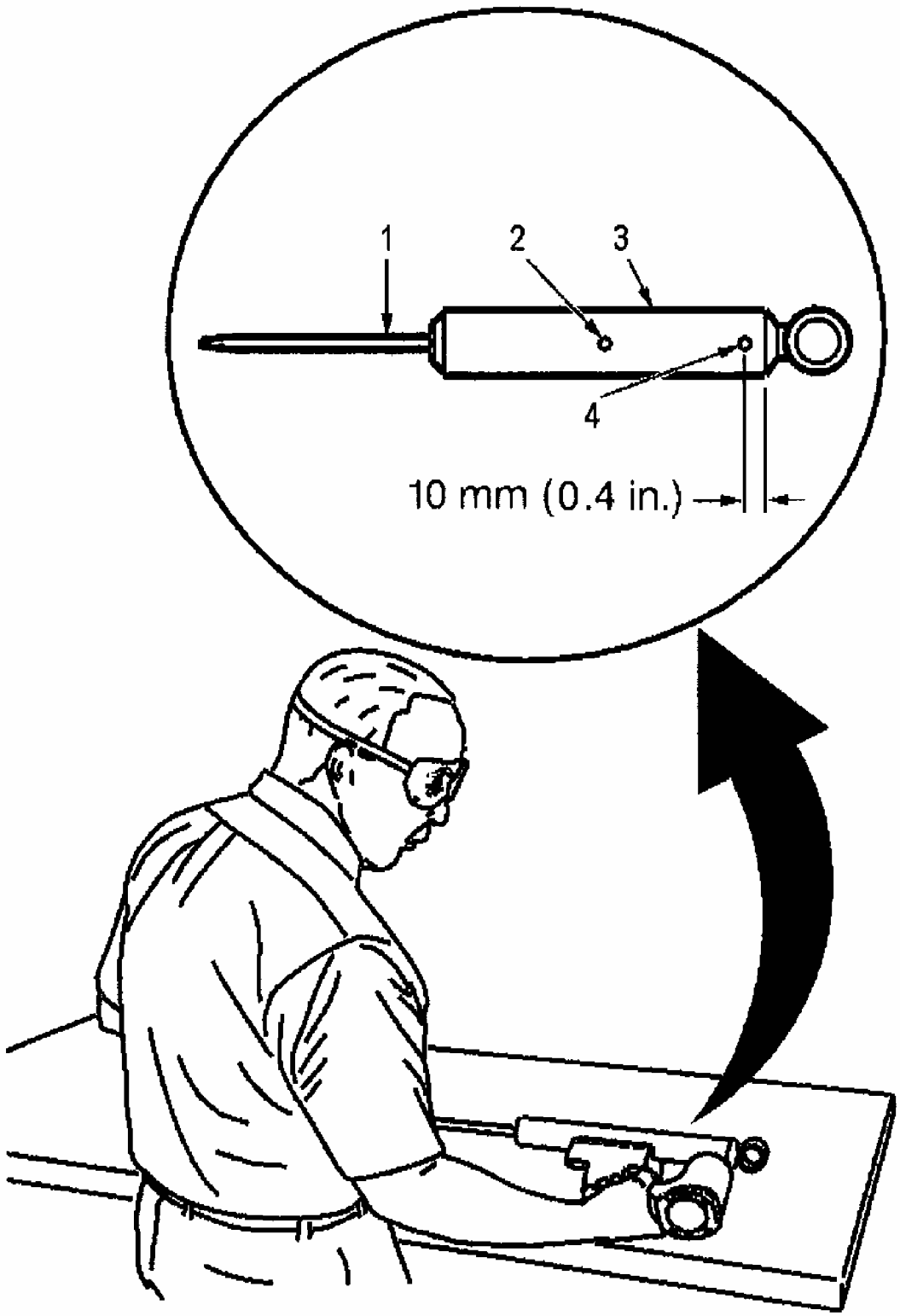


Fig. 128: Disposing Shock Absorber

Courtesy of GENERAL MOTORS CORP.

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION (COIL SPRING)

The front suspension has 2 primary purposes:

- Isolate the driver from irregularities in the road surface.
- Define the ride and handling characteristics of the vehicle.

The front suspension absorbs the impact of the tires travelling over irregular road surfaces and dissipates this energy throughout the suspension system. This process isolates the vehicle occupants from the road surface. The rate at which the suspension dissipates the energy and the amount of energy that is absorbed is how the suspension defines the vehicle's ride characteristics. Ride characteristics are designed into the suspension system and are not adjustable. The ride characteristics are mentioned in this description in order to aid in the understanding of the functions of the suspension system. The suspension system must allow for the vertical movement of the tire and wheel assembly as the vehicle travels over irregular road surfaces while maintaining the tire's horizontal relationship to the road.

This requires that the steering knuckle be suspended between an upper and a lower control arm. The lower control arm attaches from the steering Knuckle at the outermost point of the control arm. The attachment is through a ball and socket type joint. The innermost end of the control arm attached at 2 points to the vehicle frame, through semi-rigid bushings. The upper control arm attaches to the frame in the same fashion. Between the lower control arm and a spring seat on the vehicle's frame, under tension, is a coil spring.

This up and down motion of the steering knuckle as the vehicle travels over bumps is absorbed predominantly by the coil spring. The vertical movement of the steering knuckle as the vehicle travels over irregular road surfaces will tend to compress the spring and spring tension will lead the spring to return to the original, at-rest state. This action isolates the vehicle from the road surface. The upper and lower control arms are allowed to pivot at the vehicle frame in a vertical fashion. The ball joint allows the steering knuckle to maintain the perpendicular relationship to the road surface.

A shock absorber is used in conjunction with this system in order to dampen out the oscillations of the coil spring. A shock absorber is a basic hydraulic cylinder. The shock is filled with oil and has a moveable shaft that connects to a piston inside the shock absorber. Valves inside the shock absorber offer resistance to oil flow and consequently inhibit rapid movement of the piston and shaft. Each end of the shock absorber is connected in such a fashion to utilize this recoil action of a spring alone.

Front suspensions systems utilize a stabilizer shaft. The stabilizer bar connects between the left and right lower control arm assemblies through the stabilizer link and stabilizer shaft

insulators. This bar controls the amount of independent movement of the suspension when the vehicle turns. Limiting the independent movement defines the vehicle's handling characteristics on turns.

GENERAL DESCRIPTION (TORSION BAR)

The front suspension has 2 primary purposes:

- Isolate the driver from irregularities in the road surface.
- Define the ride and handling characteristics of the vehicle.

The front suspension absorbs the impact of the tires travelling over irregular road surfaces and dissipates this energy throughout the suspension system. This process isolates the vehicle occupants from the road surface. The rate at which the suspension dissipates the energy and the amount of energy that is absorbed is how the suspension defines the vehicle's ride characteristics. Ride characteristics are designed into the suspension system and are not adjustable. The ride characteristics are mentioned in this description in order to aid in the understanding of the functions of the suspension system. The suspension system must allow for the vertical movement of the tire and wheel assembly as the vehicle travels over irregular road surfaces while maintaining the tire's horizontal relationship to the road.

This requires that the steering knuckle be suspended between an upper and a lower control arm. The lower control arm attaches from the steering knuckle at the outermost point of the control arm. The attachment is through a ball and socket type joint. The innermost end of the control arm is attached at 2 points to the vehicle frame through semi-rigid bushings. The upper control arm attaches to the frame in the same fashion. Attached to the lower control arm is a torsion bar. Torsion bars are steel or steel composite shaft that connects from the lower control arm an adjustable mount at the torsion bar crossmember. The torsion bar functions as a spring in this suspension system. The torsion bar absorbs energy from irregular road surfaces by twisting force along the center axis. The torsion bar has a resistance to this twisting motion and will return to the original, at-rest position similar to that of a spring.

A shock absorber is used in conjunction with this system in order to dampen out the oscillations of the torsion bar. A shock absorber is a basic hydraulic cylinder. The shock is filled with oil and has a moveable shaft that connects to a piston inside the shock absorber. Valves inside the shock absorber offer resistance to oil flow and consequently offer resistance to rapid movement of the piston and shaft. Each end of the shock absorber is connected in such a fashion in order to utilize this recoil action of a torsion bar alone.

Front suspension systems utilize a stabilizer shaft. The stabilizer bar connects between the left and right lower control arm assemblies through the stabilizer link and stabilizer shaft insulators. This bar controls the amount of independent movement of the suspension when the vehicle turns. Limiting the independent movement defines the vehicle's handling characteristics on turns.

SPECIAL TOOLS AND EQUIPMENT

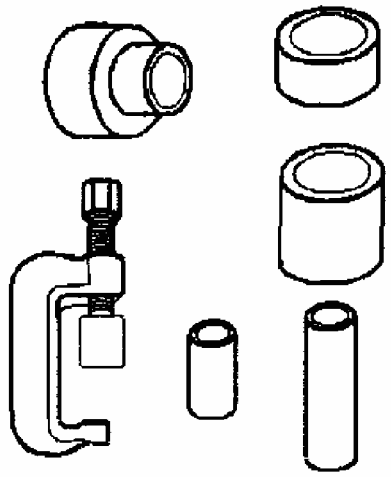
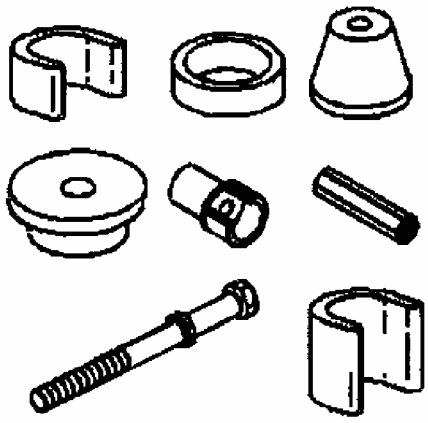
Illustration	Tool Number/Description
	J 9519-D Ball Joint Remover and Installer Set
	J 21474-01 Control Arm Bushing Service Set

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Fig. 129: Special Tools & Equipment (1 Of 3)
Courtesy of GENERAL MOTORS CORP.

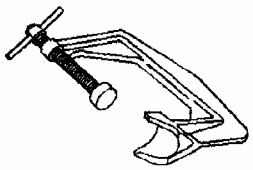
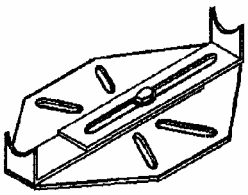
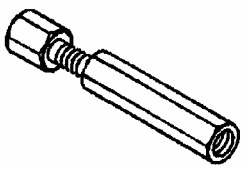
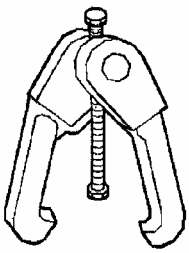
Illustration	Tool Number/Description
	J 22269-01 Accumulator and Servo Piston Remover
	J 23028-01 Coil Spring Remover and Installer
	J 23742 Ball Joint Separator
	J 24319-B Steering Linkage and Tie Rod Puller
	J 29117-A Wheel Bearing Cup Remover

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Fig. 130: Special Tools & Equipment (2 Of 3)
Courtesy of GENERAL MOTORS CORP.

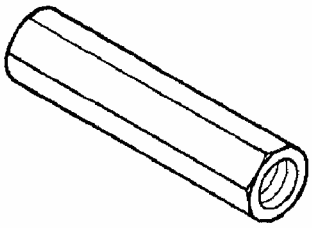
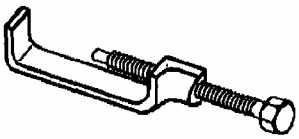
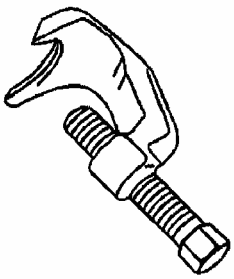
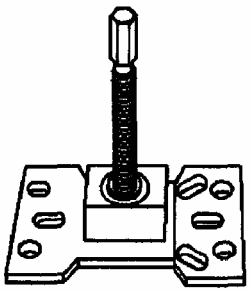
Illustration	Tool Number/Description
	J 29193 Steering Linkage Installer
	J 36202 Torsion Bar Loading/Unloading Tool
	J 43631 Ball Joint Remover
	J 45859 Axle Remover

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Fig. 131: Special Tools & Equipment (3 Of 3)
Courtesy of GENERAL MOTORS CORP.